NOTE

Subject: EPA Comments on MidAmerican Energy Co, George Neal North Power Station, Sergeant Bluff, IA
Round 7 Draft Assessment Report

To: File
From: Jana Englander, OSWER, US EPA

Date: January 27, 2011

1. On p. 25 the report states that the plant is regulated NPDES Permit No. 97-00-1-02 and that this permit was effective on April 1, 1998 and expired on March 31, 2003. Has there been activity to renew the permit, please clarify status.

2. On p. 30, the report states that "the overall visual assessment is that the earthen embankments that impound Pond 1, Pond 2, and Pond 3 are in good condition." Replace "good" with "satisfactory," a measurable condition.

3. Pp. 67, 68, 70, 77, 79, and 80: photos 1.2, 1.8, 1.10, 1.12, 1.16, 3.11, 3.17, 3.22 appear to be corrupted.

4. Please elaborate on the Satisfactory rating as the bold text from the following citations make it appear somewhat questionable:

   - On p. 11, the rating appears to be made based upon the condition that MidAmerican will adequately maintain the perimeter, vs, what they may actually be doing currently: "In accordance with EPA criteria the perimeter dike system impounding the ash ponds, and including the outlet works, at NNEC is rated SATISFACTORY for continued safe and reliable operation. **This rating presumes that MidAmerican will adequately maintain the perimeter dike and outlet works and operate the ponds within the operating conditions recommended by HWS."**

   - On p. 10, this statement gives the appearance that MidAmerican is not currently following HWS recommended operating conditions: "**The inspection program is generally substandard**."

   - On pp. 59-60, statements are provided that give the appearance that a structural failure may be possible: "As previously mentioned, the low dike section at Pond 3B South occurs in an area that appears to have been in or on the margins of the oxbow lake, where soft compressible soils could occur or where the initial layers of embankment fill may have been placed in water. **The test borings made by HWS appear to verify the presence of such soils in the deeper part of the embankment and to a lesser extent in the foundation; thus, the low dike crest could potentially have been the result of consolidation settlement and/or possibly progressive shear failure in the soft soils, particularly in the lower part of the embankment, which after 35 years may have stabilized. Nevertheless, after the dike is raised back up to the design elevation of 1085 feet, it would be prudent to install at least two temporary elevation monuments, one on the crest and one at the outside toe of the section where the lowest crest elevation occurred, and take elevations on the monuments monthly for 6 months after the initial elevation measurements, to assess whether settlement or subsidence re-initiates or continues after addition of the fill to finished grade; the monument at the toe would serve to check for heave in case of shear failure, although heave may not show in a progressive failure.** After 6 months the monitoring data would be assessed to determine if monitoring should continue for further evaluation or be terminated. Since the lowest dike section occurs near the outlet structure and because rejuvenated movement of the embankment earth fill could potentially have some impact on the outlet pipe, the elevation monitoring after restoring the dike crest elevation is considered a reasonable precaution."

State: None

Company: See attached letter dated March 4, 2011

MidAmerican ENERGY
OBSESSIVELY, RELENTLESSLY AT YOUR SERVICE.

4299 NW Urbandale Drive
Urbandale, Iowa 50322

March 4, 2011

Delivered via Overnight Mail

Mr. Stephen Hoffman
U.S. Environmental Protection Agency
Two Potomac Yard
2733 South Crystal Drive
5th Floor, N-5237
Arlington, Virginia 22202-2733

Re: Comments to Draft Coal Combustion Waste Impoundment Round 7 Dam Assessment Reports for Neal North Energy Center (Site #13), Walter Scott Energy Center (Site #14), Riverside Generating Station (Site #15), and Louisa Generating Station (Site #16)

Dear Mr. Hoffman:

MidAmerican Energy Company ("MidAmerican") appreciates the opportunity to review the subject reports and provide its comments prior to the reports' finalization. MidAmerican has been handling and continues to handle coal combustion residue and manage its surface impoundments in a safe and environmentally sound manner, including the safe and beneficial use of coal combustion residue in multiple applications for over twenty years. MidAmerican takes its environmental responsibilities seriously and continues to pursue opportunities to demonstrate respect for the environment. As such, any improvement items highlighted in the surface impoundment reports will be, or have been, addressed in a timely and diligent manner. Specific action items and comments are outlined in more detail below on a site-by-site basis.

Walter Scott Energy Center Draft Report Comments

The draft report for this facility provides an assessment of **"Fair"** for both the South Surface Impoundment and the North Surface Impoundment. Pursuant to the report, the presence of sloughing on the levee side of the South Surface Impoundment and the need to further document the safety of the embankments under certain modes of failure were the primary contributors to this ranking. However, since the on-site inspection was conducted in September 2010, a great deal of work has been accomplished to specifically address these issues. As a result, MidAmerican respectfully requests that the ranking for both of these surface impoundments be changed to **"Satisfactory"** in the final report. The evidence to support this request is provided below.

<u>South Surface Impoundment Levee Sloughing</u>
The Mills and Pottawattamie (M&P) Missouri River Levee District and the U.S. Army Corps of Engineers completed these repairs in February 2011 as shown in the photographs below. Large rip-rap was utilized to fill and stabilize the eroded portion of the levee, followed by a cover layer of soil and seeding.

Photo 1 - Levee District and Corps of Engineers starting repairs to slough

Photo 2 – Same area with final cover over slough area and graded

Comments to Specific Report Sections

Section 1.1.1: On February 11, 2011, Terracon completed a supplement analysis to calculate the liquefaction potential of the surface impoundment levee structures. The report can be found in Attachment A. The report concludes that "the factor of safety for liquefaction potential is above 1.6 for the sandy alluvial soils observed in [the] borings." In addition, the report evaluated a lower elevation embankment in the area of Station 22+00 to 25+00. For this section of the levee, a factor of safety was calculated to be "in excess of 1.8 for both steady state and pseudo-static seismic stability." These values are well above the minimum acceptable value and demonstrate that the liquefaction potential and seismic stability are not areas of concern for the Walter Scott surface impoundments.

Section 1.1.3: Subsequent to the on-site inspection, the Walter Scott facility has been able to obtain the Southwest Iowa Renewable Energy rail spur construction drawings. Those drawings are provided in Attachment B.

Section 1.1.5: The report indicates that the damaged end of the outlet structure should be repaired to restore the structure to serviceable condition. The M&P Missouri River Levee District and Corps of Engineers are in the process of repairing these structures which were damaged by their previous subcontractor during straightening of the Pony Creek drainage way. Photograph 3 below shows the current status of the repairs. The photo was taken facing north showing the repaired discharge structure (located immediately below the orange cone) in the south bank of the North Surface Impoundment. This update also applies to section 1.2.5.

Photo 3 – Repaired outlet structure

Section 1.1.7: The report indicates that the inspection program is substandard, and that a formal inspection program should be developed and implemented. Walter Scott Energy Center has now adopted a formal quarterly levee inspection program which follows the recommendations in report Section 9.3.1. The new inspection form, shown in Attachment C, began to be utilized in late 2010. The facility plans on continuing inspections with formal logs for both surface impoundments on at least a quarterly basis.

Section 1.2.6: The facility continues to make periodic inspections and repairs as necessary to address pond-side slope erosion caused by wave actions on the South Surface Impoundment on the north and south sides. The facility is also monitoring wave action on the northeast corner of the North Surface Impoundment and will make a further assessment on placement of rip rap for wave erosion protection in late spring 2011. Photographs 4-7 detail the repairs made to the South Surface Impoundment following the on-site inspection in September 2010.

Photo 4 – Placed rip-rap to protect wave erosion action
North side of South Surface Impoundment

Photo 5 - Close up view of rip-rap protection
North side of South Surface Impoundment

Photo 6 – Placed rip-rap to protect wave erosion action
Southwest side of South Surface Impoundment

Photo 7 – Placed rip-rap to protect wave erosion action
Southeast side of South Surface Impoundment

Section 2.3: In the *North Ash Pond* portion of this section, please revise the following sentence to include the underlined wording: "Fly ash disposal in the pond was terminated by December 31, 2007; fly ash is currently dry-disposed in an ash monofill <u>or sold for beneficial reuse</u>."

Section 3.2: The first paragraph reads, "The WSEC is currently regulated under NPDES Permit No. 78-20-1-01 (see Appendix C – Doc 1.6). This permit was effective on February 27, 2003, amended October 16, 2006, and expired on February 26, 2008, according to the furnished documentation." For clarification, please add the following sentence: "However, a permit renewal application was timely submitted to the Iowa Department of Natural Resources prior to expiration."

Section 4.2.2: The report states that "All fly ash now is captured in silos and is sold for beneficial reuse or sent to an ash monofill." MidAmerican suggests that this should be rephrased to "All fly ash now is captured in silos and is sold for beneficial reuse or sent to an on-site, lined coal combustion residue monofill."

Section 6.1.1: Please delete the phrase "Hearsay evidence from MidAmerican staff is that", and replace it with "According to MidAmerican staff." Additionally, the high water levels observed during the on-site inspection have in fact dropped considerably. At elevation 971.5', the water level surrounded the base of the pole shown in Photograph 8. At that elevation there was still approximately 2' of freeboard remaining to the lowest point on the levee structure. As can be seen in the photo, the water level has dropped several feet, and it is estimated that there is now approximately 5’ of freeboard in the surface impoundments.

Photo 8 – Facing northwest showing southeast bank of South Surface Impoundment

Section 8.1: The report indicates that “Water is discharged through the outlet structure to Pony Creek”. This statement is not accurate, and should be changed to “Water can be discharged through the outlet structure to Pony Creek”. While the capability exists, water has not discharged through this outlet structure in many years.

Also, please replace all references of “ash monofill” with “coal combustion residue monofill”, or “CCR monofill”. This revised description is consistent with how the facility is described within the Iowa Department of Natural Resources permits.

Lastly, the final sentence in the second paragraph states that “MidAmerican indicated that the ash material is tested for arsenic before being used for beneficial purposes.” While this statement is accurate, MidAmerican also tests for antimony, barium, cadmium, chromium, mercury, selenium, and thallium. That stated, it would be more accurate to rephrase to “MidAmerican indicated that the ash material is tested pursuant to the beneficial reuse requirements of Iowa Administrative Code 567 Chapter 108.”

Section 9.1: “Pottawattamie and Lee Counties” should be changed to “Pottawattamie and Mills County”.

Neal North Energy Center Draft Report Comments

The draft report for this facility provides an assessment of **"Satisfactory"** for Surface Impoundments 1, 2, 3A and 3B. MidAmerican agrees with this assessment. However, a number of "action items" are outlined in the report, and this response provides an opportunity to describe the progress to date, and MidAmerican's plans to address those items. In addition, other suggested editorial changes and clarifications will be provided on a section-by-section basis.

Status of "Action Items"

1. **Section 1.1.3, First Paragraph, 3rd Sentence –** "However, MidAmerican should perform its own calculations to provide formal documentation of internal hydrologic safety of the ash ponds…"
   - This item will be completed with an engineering study by October 30, 2011.

2. **Section 1.1.5, Second Paragraph, 3rd Sentence –** "A couple of relatively shallow holes in the outside slope surface, apparently caused by seepage erosion, were observed in the perimeter dike on the northeast side near east corner of Pond 3B North. MidAmerican has been aware of this condition and has plans to reconstruct the embankment in the area in accordance with HWS' recommendations and field guidance…"
   - The engineering study will be completed by October 30, 2011.
   - Construction activities will be completed by October 30, 2012.

3. **Section 1.1.5, Third Paragraph, 1st Sentence –** "MidAmerican additionally has plans to restore embankment height back up to the design top elevation along the low section of the perimeter dike observed around much of Pond 3B South…"
   - The engineering study will be completed by October 30, 2011.
   - Construction activities will be completed by October 30, 2012.

4. **Section 1.1.5, Third Paragraph, last Sentence** – "Thus, it would be prudent to monitor potential movement after the dike is raised, and it may be of value to monitor potential movement even if the dike is not raised"
   - The engineering study will be completed by October 30, 2011.
   - Construction activities will be completed by October 30, 2012.
     - Monitoring of the movement marker will be completed every six months following construction activities for one year. If any movement is identified, monitoring activities will continue every six months until movement ceases and addressed as necessary.

5. **Section 1.1.5, Fourth Paragraph, 1st Sentence –** "MidAmerican also plans to remove a relatively large berm of material, determined to be bottom ash and coal residuals, observed on the outside slope of the perimeter dike on the west side of pond 1..."
   - Permit application(s) will be submitted by April 15, 2011, to the appropriate regulatory agencies.
   - The project will be completed by November 30, 2011.

6. **Section 1.1.6, Second Paragraph, 3rd Sentence –** "However, the bare outside slope of the perimeter dike at the offset near the south corner of Pond 3A should be protected against erosion."
   - The project will be completed by October 30, 2011.

7. **Section 1.2.7, 1st Sentence –** "It is recommended that the inspection program be formalized…"
   - An operating and maintenance (O&M) plan was developed for this facility on February 22, 2011. Refer to Attachment D for a copy of the current O&M Plan.

8. **Section 9.2.1, First Paragraph, 3rd Sentence –** "MEC plans to install a fixed staff gage in Pond 1 to allow visual monitoring to verify that the water level stays below the maximum water elevation of 1078.5' recommended in the HWS Geotechnical Engineering Report."
   - The gage will be installed by July 31, 2011.

<u>Suggested Editorial Changes and Clarifications</u>

Section 2.1, 6th paragraph: Please add "process water" to the third sentence as part of the description of what is discharged to the surface impoundment.

Section 2.1, 9th paragraph: Please change the word "obliterated" to "removed".

Section 2.2, 1st paragraph: It would be more accurate to rephrase the following sentence to add the underlined wording: "The surface impoundment <u>discharges</u> are regulated by the Iowa Department of Natural Resources <u>under the National Pollutant Discharge Elimination System program</u>."

Section 2.3, 3rd paragraph: In the second sentence, please add "process water" to the description of what is discharged to the surface impoundment.

Section 2.4.2, 2nd paragraph: Please add "Water is sampled at this location for water-quality monitoring regulated by the plant's NPDES permit." after the sentence ending in "fitted with a staff gage."

Section 2.4.2, 5th paragraph: Please delete "and water is sampled for water quality monitoring."

Section 2.4.2, 6th paragraph: Please change the underlined portion of the following sentence: "The south part of Pond 2 is currently being excavated to restore storage volume, but when that area of the pond again receives sluice water and plant drainage water, it is presumed that water from that area will drain to the southeast part of Pond 2…" In addition, the next sentence in that paragraph should change "southwest" to "northwest".

Section 5.2.2: In the "Pond 2 Outlet Conduit" section, please reword the last sentence of the paragraph to delete "of the bottom ash and C-stone" and insert "excavation of ash" instead.

Section 5.3.2: In the "Pond 3A Outlet Conduit" section, the actual pipe is roughly 150-200 feet further north from the outlet structure. The pipe referenced in the document is the emergency high overflow pipe that is never used. Water discharging from 3A to 3B has a greater distance to travel before being discharged from the outfall.

Section 6.1.4, 3rd paragraph: "Beecause" is misspelled.

Table 7.5: The initial recommended ash pond operating condition for 3B south was 1079'. An additional study revealed that the pond could safely operate at 1079.5'. Please refer to Attachment E for additional details concerning this revised assessment.

Section 8.1: The sentence discussing the Neal 4 ash operations doesn't belong in this report and should be deleted. The Neal 4 facility is physically separate from Neal North, and its ash is independently managed.

Photo 1.1 Description: Please change the caption wording from "only" to "approximately".

Photos 1.13, 3.6, 3.16, 3.18, 3.32: To maintain consistency with the remaining site photos, these referenced photos should have the Neal South plant "cropped out".

Photo 2.8: The photo caption should read "Pond 1", not "Pond 2".

Riverside Generating Station Draft Report Comments

The draft report for this facility provides an assessment of **"Poor"** for the South Surface Impoundment. Pursuant to the report, the South Surface Impoundment is marginally stable under static steady state seepage conditions and does not meet appropriate safety factors against failure. However, since the on-site inspection was conducted in September 2010, a great deal of additional investigation and analysis has been completed to specifically address these issues. As a result, MidAmerican respectfully requests that the ranking for South Surface Impoundments be changed to **"Fair"** in the final report. In addition, once the levee improvement project is completed this year, the ranking should be changed to "**Satisfactory**". The evidence to support this request is provided below.

Supplemental Geotechnical Investigations

Supplemental geotechnical on-site investigation, additional soil borings, field and laboratory soil tests, and a geotechnical report was performed by Terracon on December 7, 2010. While this information was provided to Dewberry on December 17, 2010, it appears that the findings of the analysis were not incorporated into the facility draft report, nor was it utilized to determine the ranking of the South Surface Impoundment. Please refer to Attachment F for a copy of this report.

During the subsequent investigation, an additional eight (8) borings were taken and cone penetrometer soundings were completed to supplement the borings and soil characteristics. These additional tests allowed Terracon to better define existing soil conditions and provide better soil parameters to perform a final soil analysis for the stability of the ash pond. The revised soil analysis indicated a noticeable improvement in the factor of safety for slope stability.

The December 7, 2010, geotechnical report in Table 4 shows the existing embankment sections exhibit factors of safety between 1.25 and 1.32. This is a significant improvement over the initial results, but is still slightly less than the desired factor of safety of 1.4 for the long term steady state seepage condition.

Table 4. Existing Embankment Under Conditions of Steady State Seepage

	Estimated Factor of Safety Obtained from Analysis	
	Steady State Seepage Design Condition	
Section[1]	Required Minimum Factor of Safety[2]	Riverside Slope
A	1.4	1.30
B	1.4	1.25
C	1.4	1.26
D	1.4	1.32
E	1.4	1.26

1. Refer to Ash Pond Plan in Exhibit D-1, for cross section location.
2. Reference: Table 6.1b (EM 1110-2-1913)

As a result of the slightly lower than desired safety factors, MidAmerican immediately developed a project implementation program to further improve the embankment of the South Surface Impoundment to the desired factor of safety of greater than 1.4 for slope stability. Refer to Attachment G for the preliminary plans to stabilize the embankment via placement of a geogrid. Copies of the permits received from the Iowa Department of Natural Resources and the Army Corps of Engineers approving the work are included in Attachment H. Based on the implementation of this levee improvement plan, the following factors of safety, shown in Table 5 and Table 6, will be achieved (from December 7, 2010, Terracon geotechnical report).

Table 5. Stabilized Embankment Slopes Under Conditions of Steady State Seepage

Section[1]	Estimated Factor of Safety Obtained from Analysis — Steady State Seepage – Stabilized Slope: Required Minimum Factor of Safety[2]	Riverside Slope
A	1.4	1.44
B	1.4	1.45
C	1.4	1.42
D	1.4	1.51
E	1.4	1.42

1. Refer to Ash Pond Plan in Exhibit D-1, for cross section location.
2. Reference: Table 6.1b (EM 1110-2-1913)

Table 6. Stabilized Embankment Slopes Under Conditions of Sudden Drawdown

Section[1]	Estimated Factor of Safety Obtained from Analysis — Sudden Drawdown Conditions – Stabilized Slope: Required Minimum Factor of Safety[2]	Riverside Slope
A	1.2	1.23
B	1.2	1.26
C	1.2	1.25
D	1.2	1.26
E	1.2	1.25

1. Refer to Ash Pond Plan in Exhibit D-1, for cross section location.
2. Reference: Table 6.1b (EM 1110-2-1913)

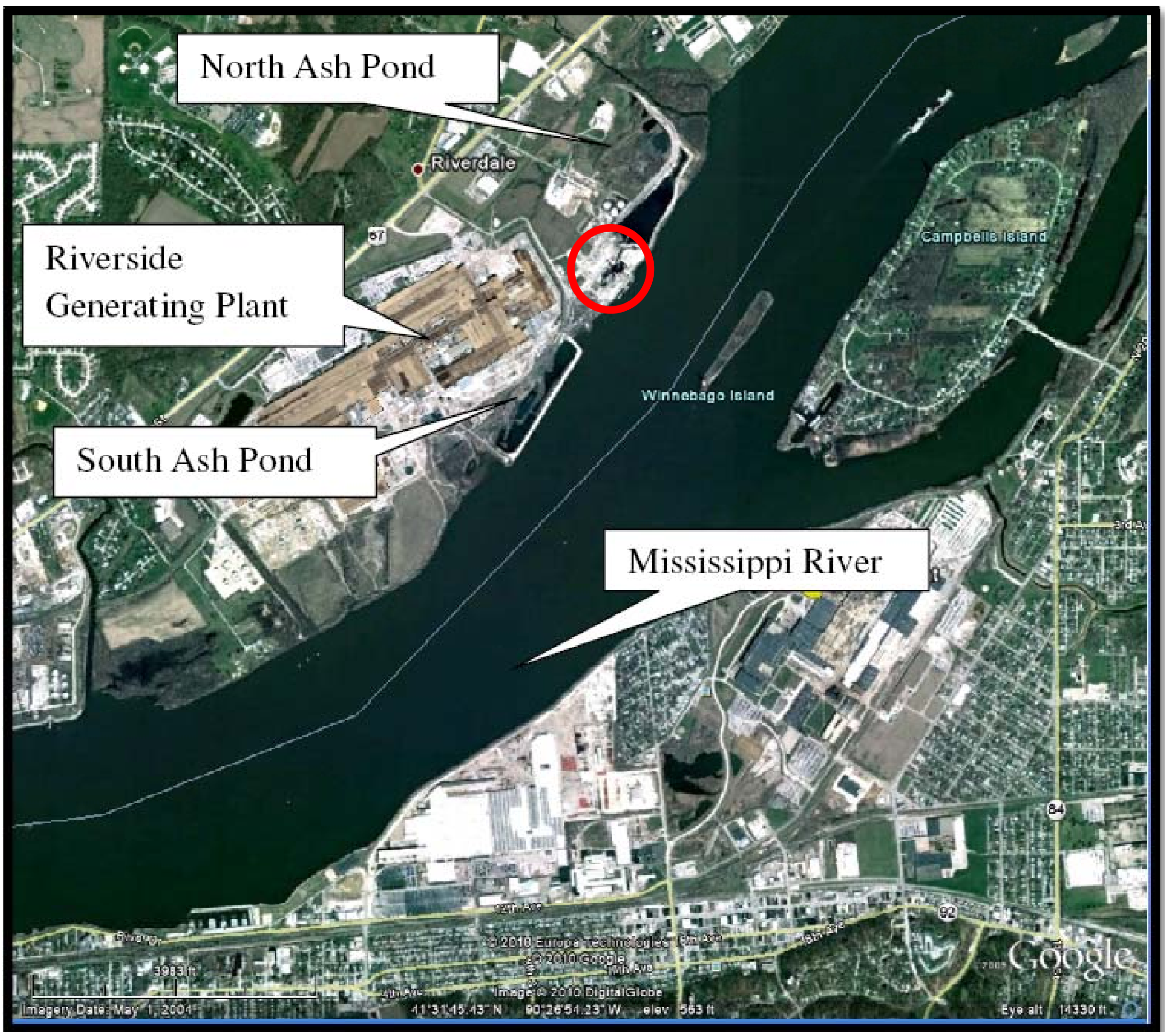
It is expected that the levee improvement work at the South Surface Impoundment will begin in the spring/summer of 2011, once Mississippi River water levels and weather are conducive to initiating construction activities. As a result, the expected project completion date is summer/fall of 2011. Once this project is complete, the slope stability under steady state seepage and sudden drawdown conditions will exceed the required factors of safety. MidAmerican will then notify the Environmental Protection Agency that the project is finished, and the ranking for the South Surface Impoundment should be able to be improved to "**Satisfactory**" at that time.

Comments to Specific Report Sections

Section 1.1.: The draft report indicates that the South Surface Impoundment is marginally stable and does not meet appropriate safety factors against failure. This assessment was based on the preliminary reports prior to more extensive geotechnical site investigations and issuance of the final geotechnical report dated December 7, 2010. The additional testing and analyses demonstrate factors of safety which are considerably improved from the initial results, although they are slightly less than the desired factor of safety. These improved safety factors should be taken into consideration in this section, in the final rating, and included in the overall report.

Section 1.2.1 & 1.2.3: On January 14, 2011, Terracon performed a seismic analysis of the Riverside South Surface Impoundment. The report, provided in Attachment J, demonstrated results of global stability factors of safety ranging from 1.28 to 1.37; well above required minimum factor of safety range from 1.0 to 1.1. MEC submitted these reports to Dewberry on January 25, 2011, but it does not appear that the report results were included in the draft report documentation. Please utilize these report results in your final assessment for the Riverside facility.

Figure 2.1-2: The photo incorrectly labels Alcoa as the Riverside Generating Plant. Riverside is actually just north of the South Surface Impoundment (South Ash Pond) as shown in the red circle below.



Section 2.4.1: Several additional borings and cone penetrometer tests were conducted as part of the December 7, 2010, and January 14, 2011, test reports which should allow deletion or revision of the following statement: "MEC personnel provided limited subsurface data consisting of boring logs used in conjunction with monitoring well installations." Please also add a statement that MidAmerican personnel provided supplemental geotechnical reports, boring logs which identified subsurface data, and cone penetrometer test soundings to supplement the borings initially provided during the on-site inspections.

Figure 2.5-1: It should be recognized that the vast majority of these critical infrastructures are at a relatively high elevation and would not be impacted by any potential breach of the surface impoundment levee structure.

Section 4.2.1: This section should be revised to reflect that the north pond accepts only stormwater from the coal pile and there is no discharge, and that the south pond accepts the noted wastewater including storm water from some plant roofs and some paved areas, and discharges through a permitted National Pollutant Discharge Elimination System outfall.

Section 7: This entire section should be updated to reflect the supplemental reports completed on December 7, 2010, and January 14, 2011.

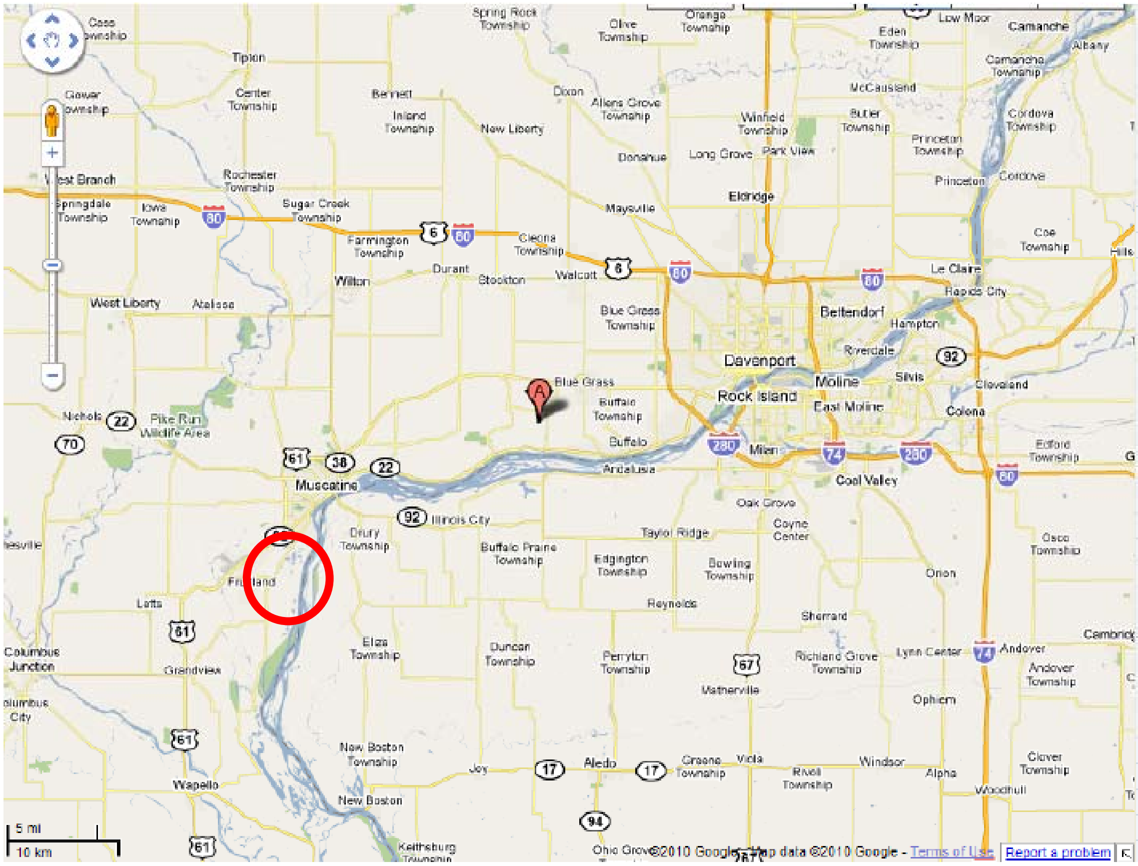
Section 7.1.1: Riverside Generating Station is in Scott County, not Louisa County.

<u>Louisa Generating Station Draft Report Comments</u>

The draft report for this facility provides an assessment of **"Satisfactory"** for its surface impoundments. MidAmerican agrees with this assessment. However, a number of suggested editorial changes and clarifications are provided below on a section-by-section basis.

<u>Suggested Editorial Changes and Clarifications</u>

Section 2.1: The general description and figures 2.1a and 2.1b relate to IPSCO Steel, not Louisa. The Louisa Generating Station is further southwest near Fruitland, Iowa, as shown in the red circle on the map below.



Section 2.3: It is unclear why the surface impoundment is referred to as the North Ash Pond in this section and in other areas of the document. Louisa only has one surface impoundment, and this may be a carryover issue from the Riverside report. In addition, Louisa's surface impoundment accepts stormwater from the main plant, scrubber area, and some building roof drains. Please refer to Attachment I for a drawing detailing the stormwater flow paths. Coal pile runoff is also permitted through National Pollutant Discharge Elimination System Outfall 004, however actual flow has never been observed.

Section 2.5: This section appears to reference the IPSCO Steel facility again. Within five miles south of Louisa, the only "highway" is Country Road X61 (Stewart Road), some residences, no businesses, no restaurants, and no places of worship. There are also no schools, nursing homes, or fire stations.

Section 4.2.1: Same comment to stormwater as in Section 2.3 above. This is also noted in Sections 6.1.1, 6.1.2, and 6.1.3.

Section 7.1.6: The last sentence in the section appears to be a heading which doesn't belong to the paragraph: "Adequacy of Supporting Technical Documentation".

General: An Operating and Maintenance (O&M) plan is being developed and will substantially mirror the Neal North Energy Center O&M Plan provided in Attachment D. Trees along the south and north exterior walls still need to be removed; MidAmerican is developing a plan for this activity which is expected to begin in spring 2011.

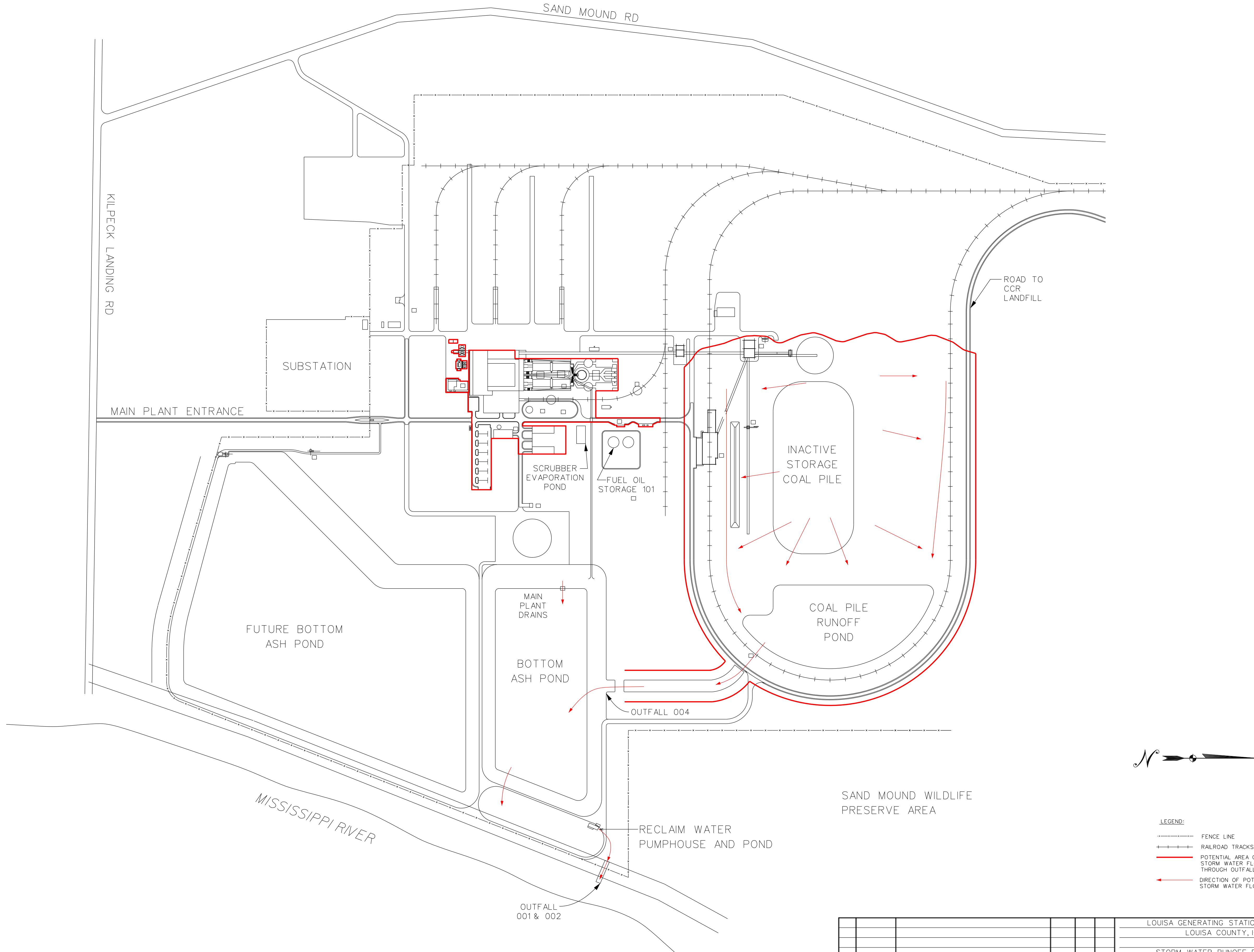
Again, MidAmerican appreciates the opportunity to review and provide its comments on the draft surface impoundment reports for Walter Scott Energy Center, Neal North Energy Center, Louisa Generating Station, and Riverside Generating Station. If you have any questions or require additional information, please don't hesitate to contact me.

Sincerely,

Kevin D. Dodson
Director – Environmental Programs,
Compliance and Permitting
Phone: 515-281-2692
kddodson@midamerican.com

Attachments

cc: Jim Kohler – U.S. EPA
Dave Ulozas
Matt Finnegan
Mark Podany
Dave Maystrick
Reg Soepnel
Sam Nelson
Bill Whitney
Jim Wiegand
Doug Haiston
Dave Webb
Jenny McIvor
Jess Vilsack
Peg Roy



LEGEND:

FENCE LINE

RAILROAD TRACKS

POTENTIAL AREA OF STORM WATER FLOW THROUGH OUTFALL 002

DIRECTION OF POTENTIAL STORM WATER FLOW

REV LET	DATE	REVISION	ZONE	BY	CK'D
D	12-20-10	ADD COAL PILE RUNOFF POND		CAS	JDW
C	12-8-10	REV RED LINE AREA AND OUTFALL 001 & 002		CAS	JDW
B	6-11-09	ADD DESCRIPTIONS		CAS	JDW
A	3-27-08	INITIAL ISSUE		CAS	JDW

LOUISA GENERATING STATION UNIT 1
LOUISA COUNTY, IOWA

STORM WATER RUNOFF PLANT AREA

MIDAMERICAN ENERGY COMPANY

DRAWN C.SLENTZ CHECKED J.WIEGAND SCALE NONE
DATE 3-27-08 DATE 3-27-08

DWG.NO. STORM WATER 1

CAD NO. stormwater1.dgn
DRAWER envir

JOINT APPLICATION FORM

ITEMS 1 AND 2 FOR AGENCY USE

1. Application Number	2. Date Received

3. and 4. (SEE SPECIAL INSTRUCTIONS) NAME, MAILING ADDRESS AND TELEPHONE NUMBERS

3a. Applicant	3b. Applicant	3c. Applicant
Doug Halston - General Manager MidAmerican Energy Company Riverside Generating Station 6001 State Street Bettendorf, IA 52722	ALCOA, Inc. 4879 State Street Riverdale, IA 52722-5775	
Business (563) 333-8503 Home ( )	Business (563) 459-2000 Home ( )	Business ( ) Home ( )
4a. Authorized Agent (if any)	4b. Authorized Agent (if any)	4c. Authorized Agent (if any)
Terrence L. Smith, P.E. HGM Associates 640 Fifth Avenue Council Bluffs, IA 51502		
Phone (712) 323-0530	Phone ( )	Phone ( )

5. PROJECT DESCRIPTION AND REMARKS:

Install a sand point dewatering system at the landward crown point of the top of the berm for construction dewatering. In 200 to 300 foot phases, remove rip rap, excavate a 15 foot wide bench at approximate elevation 564.00, reconstruct embankment with geogrid stabilized embankment and reinstall rip rap. The purpose is to improve bank stability around the perimeter of the property.

6. IMMEDIATE AND ADJOINING PROPERTY OWNERS:

ALCOA, Inc., 4879 State Street, Riverdale, IA 52722-5775, (563) 459-2000

7. PROJECT LOCATION

STREET, ROAD, OR OTHER DESCRIPTIVE LOCATION	LEGAL DESCR.	QUARTER	SECTION	TOWNSHIP	RANGE
6001 State Street, Bettendorf, IA			25	78N	4E of the 5th PM

IN OR NEAR CITY OR TOWN	WATERWAY	RIVER MILE
Bettendorf/Riverdale, Iowa	Mississippi River	489
COUNTY Scott STATE IA ZIP CODE 52722		

8. Date activity is proposed to commence 03/01/2011 Date activity is expected to be completed 11/26/2011

9. Is any portion of the activity for which authorization is sought now complete? Yes ○ No ◉ If answer is "YES" give reasons in the Project Description and Remarks section.
Month and Year the activity was completed Indicate the existing work on drawings.

10. Lit all approvals or certification and denials received from other Federal, interstate, state, or local agencies for structures, construction, discharges or other activities described in this application.

Issuing Agency	Type of Approval	Identification No.	Date of Application	Date of Approval	Date of Denial

11. CONSENT TO ENTER PROPERTY LISTED IN PART 7 ABOVE IS HEREBY GRANTED. Yes ◉ No ○

12. APPLICATION VERIFICATION (SEE SPECIAL INSTRUCTIONS)

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and that to the best of my knowledge and belief, such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

Terrence L. Smith, P.E.   1/07/11
Signature of Applicant or Authorized Agent   Date

Signature of Applicant or Authorized Agent   Date

Signature of Applicant or Authorized Agent   Date

☐ Corps of Engineers Sept. 1987
☐ Iowa Dep't of Natural Resources ATTN: Floodplain Permits Section DNR FORM 36
☐ Iowa Dep't of Natural Resources ATTN: Sovereign Lands DNR FORM 36
☐ Applicant's Copy

SEE INSTRUCTIONS FOR ADDRESS

Bettendorf IOWA

Flood Zone Development Permit

Application is hereby made to the Flood Zone Administrator of Bettendorf, Iowa, for approval of the plans and specification for the proposed development described below:

1. Address AND legal description of property involved ______________________
6001 State Street, Bettendorf, Iowa 52722
Section 26 Township 78N Range 4E of the 5th PM County: Scott Mississippi River at River Mile 489

2. FEMA FIRM Map Information: Community #__________ Panel #__________
Suffix______ Date of FIRM__________ FIRM Zone______

Proposed date of construction__________________ Base Elevation_________

3. If a building is involved in this application, it is:
New.................................______
Pre-FIRM Regulation Structure______
Post-FIRM Reg. Structure.......______
No Building Involved..............______

4. General description of proposed development (work to be performed) Install a sand point dewatering system at landward crown of top of berm for construction dewatering. In 200-300 foot phases, remove rip rap, excavate 15-foot wide bench at approx. elevation 564.00, reconstruct embankment with geogrid stabilized embankment and reinstall rip rap. Purpose is to improve bank stability around perimeter of property.

5. DETAILED INFORMATION
a) Requires excavation or filling: Yes X No __

b) Reason for excavation or fill: improve factor of safety on riverward slope

c) Area and Depth: approximately 2,000 linear feet X 40 foot width

d) Occupation Type:
Residential _____
Commercial _____
Industrial x
Agricultural _____
Other (Explain)______________________

(e) Type of fill reuse in situ granular materials, supplement with new

6. Is the property, or any portion of the property in an identified 100-year flood zone:
   YES ( ) NO ( )

7. Is the property, or any portion of the property in a floodway: YES ( ) NO ( )

8. Corps of Engineers documentation included: YES (x) NO ( ) Not Applicable ( )
   I.D.N.R. documentation included: YES (x) NO ( ) Not Applicable ( )
   FEMA documentation included: YES ( ) NO ( ) Not Applicable (x)

I certify that the elevation of the building(s) lowest floor (including basement, if applicable) will be at __________feet, NGVD (mean sea level) and that the average grade at the building site is at an elevation of ___________ feet, NGVD.

I further certify any and all work associated with this application complies with all of the requirements of APPENDIX C "Flood Area Management Ordinances" of the Municipal Code of the City of Bettendorf, Iowa.

Terrence L. Smith

CERTIFIER'S NAME

TERRENCE L. SMITH

LICENSE # or Affix Official Seal

HGM Associates Inc., 640 5th Avenue, PO Box 919, Council Bluffs, Iowa 51502-0919

Company Address, including Zip Code

Project Manager

Title

Terrence L Smith

CERTIFIER'S SIGNATURE

2/7/11

Date

Council Bluffs, Iowa

City, State

(712) 323-0530

Phone Number (including area code)

All Provisions of the City of Bettendorf, Iowa governing subdivision(s), zoning, erosion control, and building codes will be complied with by this proposed development.

____

SIGNATURE OF OWNER

PLANS AND SPECIFICATION approved this _____ day of ______________, 20__.

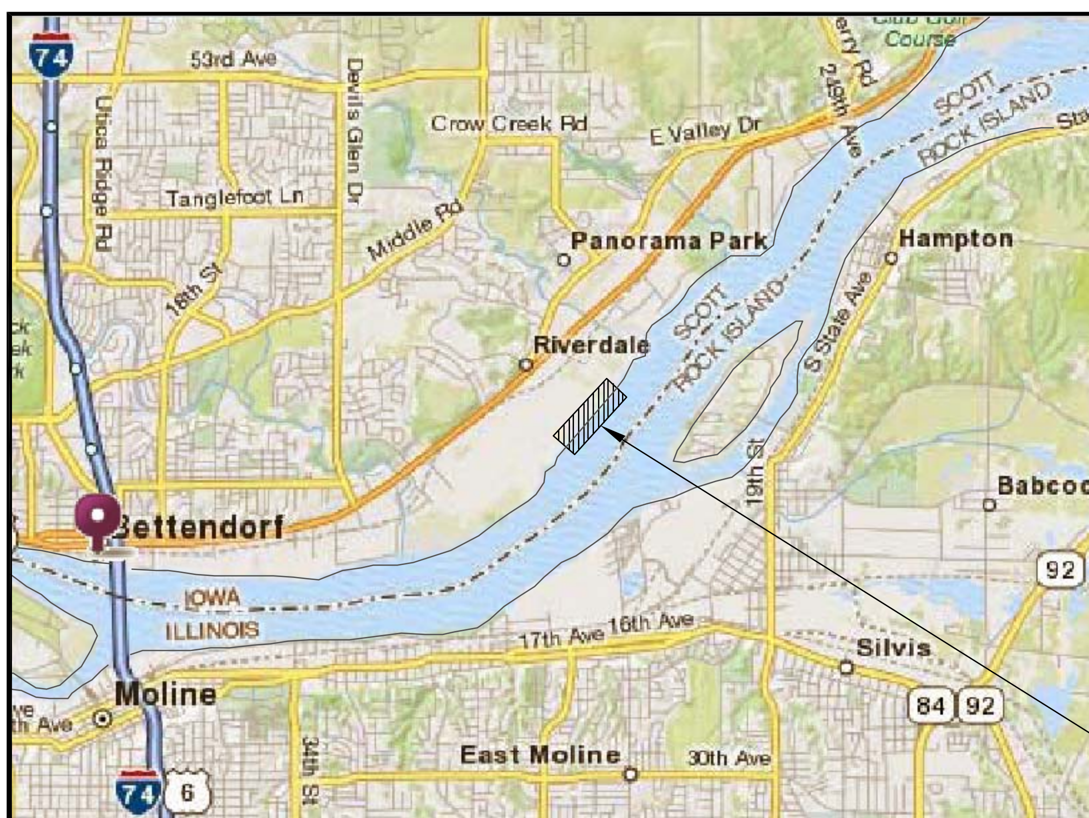
____

Bettendorf Flood Zone Administrator

RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND
EMBANKMENT IMPROVEMENTS

CITY OF BETTENDORF, IOWA

The Iowa Department of Transportation Standard Specifications for Highway and Bridge Construction, Series 2011, plus the applicable General Supplemental Specifications, Developmental Specifications, Supplemental Specifications and Special Provisions shall apply to construction work on this project unless stated otherwise in these plans and specifications.



PROJECT LOCATION

▨ – INDICATES PROJECT LOCATION

LOCATION MAP
BETTENDORF, IOWA
NO SCALE

INDEX

PAGE NO.	DESCRIPTION
A.01	TITLE SHEET, INDEX, CERTIFICATION, LOCATION MAP
A.02	SITE ACCESS
B.01	TYPICAL SECTION/GENERAL NOTES
D.01–D.03	EMBANKMENT IMPROVEMENTS PLAN, PROFILE
E.01–E.02	POLLUTION PREVENTION PLAN
X.01–X.10	CROSS SECTIONS

THESE DOCUMENTS SHALL NOT BE SCANNED, COPIED, OR DUPLICATED IN ANY MANNER.

LICENSED PROFESSIONAL ENGINEER
TERRENCE L. SMITH
13847
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

Terrence L. Smith 2/25/11
TERRENCE L. SMITH DATE

My license renewal date is December 31, 2012.

Pages or sheets covered by this seal:
A.01, A.02, B.01, D.01–D.03, E.01–E.02, X.01–X.10

hgm
ASSOCIATES INC.
640 FIFTH AVENUE COUNCIL BLUFFS, IOWA
PHONE: (712) 323-0530

LAI drawn
BJR designed
TLS approved
FEB. '11 date
revision date

project: RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND EMBANKMENT IMPROVEMENTS

client: MIDAMERICAN ENERGY COMPANY
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501

sheet: **TITLE SHEET**

project no. 112510A

sheet **A.01**

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project RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND EMBANKMENT IMPROVEMENTS

client MIDAMERICAN ENERGY COMPANY
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501

sheet **SITE ACCESS**

project no. 112510A

sheet **A.02**

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NOTES

1. THE CONTRACTOR SHALL CONSTRUCT THE STABILIZED SLOPE FACE IN A SEQUENCED MANNER SUCH THAT NO MORE THAN 300 LINEAL FEET OF THE RIVERWARD BANK OF THE LEVEE IS UNPROTECTED AT ANY ONE TIME. THE EXCAVATION AND BACKFILL WORK AT EACH SECTION SHALL BE PERFORMED ON A ROUND-THE-CLOCK BASIS UNTIL THE EXCAVATION BACKFILL REACHES THE ELEVATION OF THE ORIGINAL LEVEE CREST. THE CONTRACTOR SHALL SUBMIT A DETAILED EXCAVATION AND CONSTRUCTION SEQUENCING PLAN FOR REVIEW PRIOR TO CONSTRUCTION.

2. INCLINOMETERS SHALL BE INSTALLED ALONG THE LANDWARD CREST OF THE LEVEE EMBANKMENTS TO ALLOW MONITORING OF POTENTIAL SLOPE MOVEMENTS DURING CONSTRUCTION. INCLINOMETERS SHALL BE SET AT APPROXIMATELY 300 FOOT INTERVALS. DAILY MONITORING OF THE INCLINOMETERS SHALL BE CONDUCTED DURING EXCAVATION AND BACKFILLING TO VERIFY THAT THE CONSTRUCTION ACTIVITIES ARE NOT ADVERSELY AFFECTING THE STABILITY OF THE EMBANKMENTS.

3. DEWATERING SHALL BE PERFORMED TO ACHIEVE A MINIMUM DRAWDOWN ELEVATION OF 565 PRIOR TO ANY EXCAVATION. THE CONTRACTOR SHALL SUBMIT A DETAILED DEWATERING AND GROUNDWATER MONITORING PLAN FOR REVIEW. THE CONTRACTOR'S SUBMITTAL SHALL INCLUDE DETAILS OF WELL DESIGN, INSTALLATION, PUMP CAPACITY, AND IN-SITU MONITORING OF THE WELLS.

4. THE CONTRACTOR SHALL REUSE THE EXISTING RIPRAP THAT IS REMOVED FROM THE LEVEE FACE. THE EXISTING GRANULAR BEDDING AND ROAD SURFACING MATERIAL SHALL BE CONSIDERED PART OF THE GENERAL EXCAVATION, AND REUSED IN THE REINFORCED FILL.

5. ADDITIONAL 18-INCH NOMINAL SIZED RIPRAP SHALL CONSIST OF STONE MEETING THE MATERIAL AND SIZE REQUIREMENTS OF IDOT CLASS E REVETMENT, SECTION 4130. PROPOSED 6" THICK SAND-GRAVEL BEDDING MATERIAL UNDERNEATH THE RIPRAP SHALL MEET THE MATERIAL AND SIZE REQUIREMENTS OF IDOT GRANULAR SUBBASE, SECTION 4121, GRADATION NO. 12A OR 12B.

6. SEGREGATED MATERIAL MAY BE STOCKPILED IN THE LOCATIONS INDICATED ON SHEET E.02 AND USED FOR ANY EMERGENCY BACKFILLING OF EXISTING EXCAVATIONS SHOULD FORECASTED RIVER LEVELS EXCEED THE ELEVATION OF THE BASE OF THE CURRENT WORKING LOCATION. MATERIALS PLACED FOR EMERGENCY ACTIONS WILL BE REQUIRED TO BE REMOVED WHEN RIVER LEVELS RECEDE AND REUSED AS INDICATED.

7. LAYERS OF GEOGRID BELOW ELEVATION 572 FEET SHALL BE PLACED AT 2 FOOT VERTICAL SPACING, BEGINNING WITH THE BASE LAYER AT ELEVATION 564 FEET. THE LOWEST 4 LAYERS (ELEVATIONS 564 TO 570 FEET) SHALL BE A MINIMUM OF 10 FEET LONG.

8. FROM ELEVATION 572 FEET TO THE CREST, THE GEOGRID LAYERS SHALL BE A MINIMUM OF 15 FEET LONG. DUE TO THE VARIABLE ELEVATION OF THE LEVEE EMBANKMENT CREST, ADJUSTMENT OF THE VERTICAL SPACING IN THE UPPER LAYERS OF GEOGRID REINFORCEMENT WILL BE REQUIRED. THE TOP LAYER SHALL BE PLACED AT AN ELEVATION THAT WILL ALLOW PLACEMENT OF AT LEAST 12 INCHES OF MATERIAL ABOVE THE TOP LAYER. REFER TO THE PROFILE FOR THE REQUIRED GEOGRID SPACING IN THE UPPER LAYERS.

9. ALL GEOGRID REINFORCEMENT SHALL CONSIST OF TENSAR UX1700 UNIAXIAL GEOGRID. GEOGRID LAYERS SHALL BE PLACED WITH THE STRONG AXIS PERPENDICULAR TO THE CENTERLINE OF THE LEVEE EMBANKMENT. ALL GEOGRID LAYERS SHALL BE MANUALLY TENSIONED AND STAKED PRIOR TO SPREADING, PLACEMENT, AND COMPACTION OF THE FILL MATERIAL ON TOP OF THE GEOGRID LAYER. THE MANUFACTURER'S SPECIFICATIONS FOR STORING, HANDLING, PLACING, AND COMPACTING REINFORCEMENT AND REINFORCED FILL SHALL BE FOLLOWED.

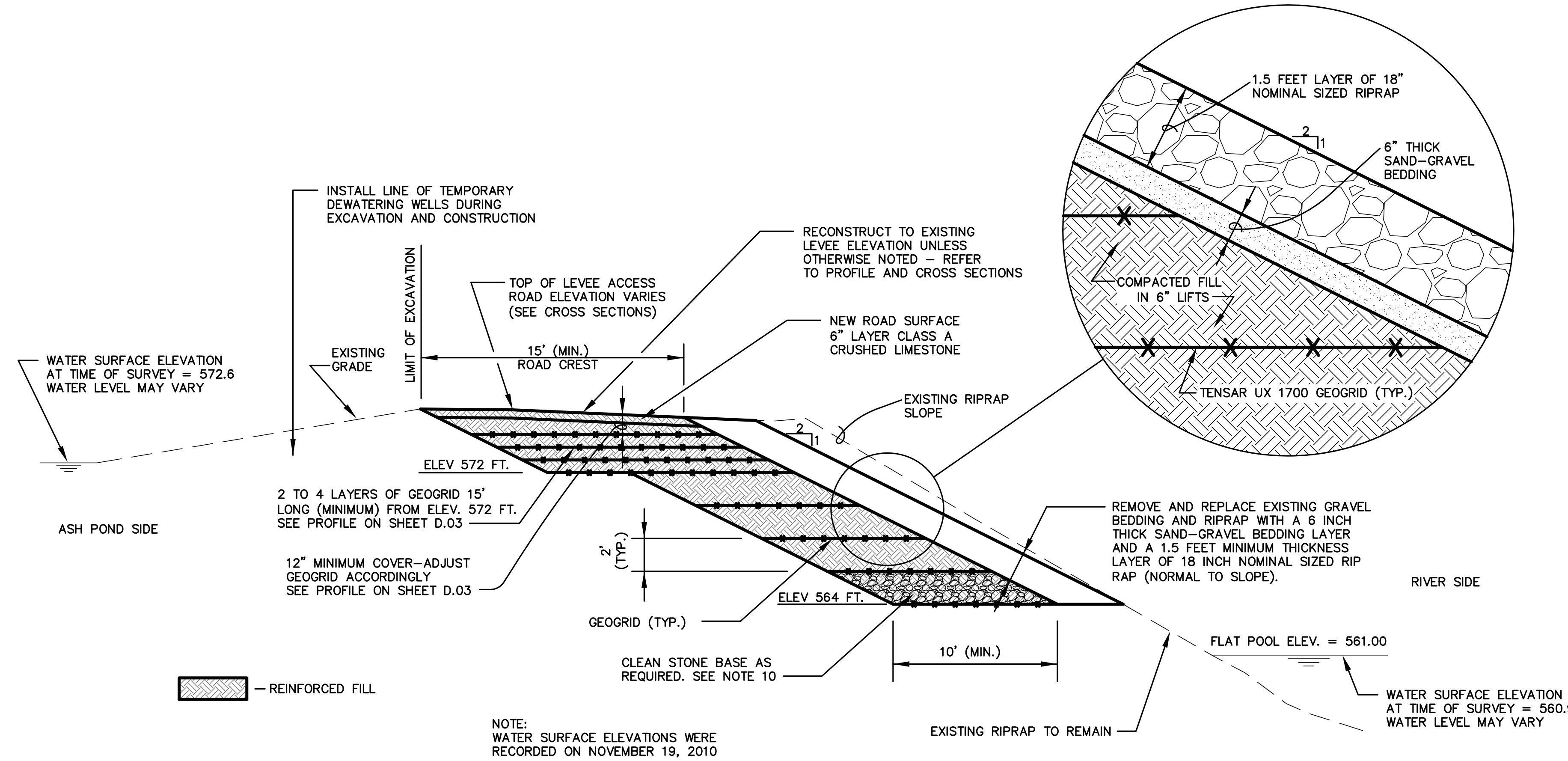
10. IF THE BASE OF THE EXCAVATION IS UNSTABLE DUE TO A HIGH RIVER ELEVATION, A CLEAN STONE BASE MAY BE USED IN THE REINFORCED AREA IN LIEU OF THE EXISTING EMBANKMENT MATERIAL. STONE SHALL ONLY BE USED WHEN THE MINIMUM DEWATERING DRAWDOWN IS BEING ACHIEVED AND WHEN APPROVED BY THE ENGINEER. CLEAN STONE SHALL MEET THE MATERIAL AND SIZE REQUIREMENTS OF IDOT COARSE AGGREGATE, SECTION 4115, GRADATION NO. 3, 4, OR 5. STONE MATERIAL SHALL BE COMPACTED IN 9-INCH LOOSE LIFTS TO AT LEAST 65 PERCENT OF THE MATERIAL'S MAXIMUM DRY DENSITY.

11. FILL MATERIAL WITHIN THE REINFORCED ZONE SHALL BE COMPACTED IN 6-INCH LIFTS TO AT LEAST 95 PERCENT OF THE MATERIAL'S MAXIMUM DRY DENSITY OBTAINED FROM STANDARD PROCTOR COMPACTION TESTS AT MOISTURE CONTENTS WITHIN A RANGE OF 3 PERCENT BELOW TO 3 PERCENT ABOVE THE OPTIMUM MOISTURE CONTENT. DENSITY AND MOISTURE CONTENT TESTING SHOULD BE PERFORMED ON EACH LIFT OF THE STABILIZED FILL AT A RATE NOT LESS THAN 1 TEST PER 2000 SQUARE FEET OF FILL. STATION-LOCATION AND ELEVATION SHALL BE RECORDED FOR EACH TEST LOCATION. THIS INFORMATION SHALL BE INCORPORATED INTO THE TEST REPORTS.

12. IF ADDITIONAL FILL MATERIAL IS REQUIRED WITHIN THE REINFORCED AREA, NEW MATERIAL SHALL MEET THE MATERIAL AND SIZE REQUIREMENTS OF IDOT SPECIAL BACKFILL, SECTION 4132, GRADATION NO. 30.

13. FOLLOWING COMPLETION OF THE STABILIZED SLOPE FACE SECTION, THE EXISTING RIPRAP EROSION CONTROL LAYER SHALL BE RECONSTRUCTED ALONG THE RIVERSIDE SLOPE FACE. THIS SECTION SHALL CONSIST OF A 6-INCH THICK SAND-GRAVEL BEDDING LAYER AND A 1.5-FOOT MINIMUM THICKNESS OF 18-INCH NOMINAL SIZED RIPRAP. LAYER THICKNESSES ARE TO BE MEASURED NORMAL TO THE 2:1 SLOPE.

14. FOLLOWING COMPLETION OF THE REINFORCED FILL SECTION, A MINIMUM 15-FOOT WIDE ROADWAY SHALL BE RECONSTRUCTED WITH A MINIMUM 6-INCH THICK, NEW IDOT CLASS A CRUSHED LIMESTONE.



TYPICAL SECTION
NO SCALE

GENERAL NOTES

1. UTILITY FACILITIES SHOWN ARE FROM LOCATES OR RECORDS PROVIDED BY OTHERS, AND SHALL BE CONSIDERED APPROXIMATE. OTHER UTILITIES MAY EXIST (EITHER IN SERVICE OR ABANDONED) AND THEIR LOCATION MAY NOT BE PRESENTLY KNOWN OR IDENTIFIED ON THE PLANS. THE ENGINEER MAKES NO GUARANTEE THAT THE UTILITIES SHOWN COMPRISE ALL UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED. THE ENGINEER FURTHER DOES NOT WARRANT THAT THE UTILITIES SHOWN ARE IN THE EXACT LOCATION INDICATED. THE CONTRACTOR SHALL NOTIFY THE IOWA ONE-CALL SYSTEM AT 1-800-292-8989 TO IDENTIFY THE LOCATION OF ALL UNDERGROUND UTILITY FACILITIES WITHIN THE CONSTRUCTION AREA.

   THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL PUBLIC AND PRIVATE UTILITY FACILITIES LOCATED WITHIN THE CONSTRUCTION AREA TO AVOID DAMAGE IN ACCORDANCE WITH SECTION 480.4, CODE OF IOWA. DAMAGE TO UTILITIES DUE TO THE CONTRACTOR'S ACTIONS SHALL BE REPAIRED OR REPLACED WITHOUT COST TO THE OWNER OR ENGINEER.

   WHERE EXISTING UTILITY FACILITIES ARE SHOWN IN THE PLANS OR ENCOUNTERED WITHIN THE CONSTRUCTION AREA, THE CONTRACTOR SHALL NOTIFY THE UTILITY COMPANY PRIOR TO BEGINNING CONSTRUCTION ACTIVITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING UTILITIES AND CONDUCTING WORK NEAR UTILITY FACILITIES REQUIRED BY SECTION 480.4, CODE OF IOWA.

   THE CONTRACTOR SHALL REVIEW ALL UTILITIES SHOWN IN THE PLANS AND COORDINATE WITH ALL UTILITY COMPANIES NECESSARY TO SCHEDULE WORK FOR ALL KNOWN AND POTENTIAL CONFLICTS. DELAYS, INCONVENIENCE, OR DAMAGE CLAIMED BY THE CONTRACTOR DUE TO ANY INTERFERENCE OF UTILITIES SHOWN IN THE PLANS SHALL NOT BE CONSIDERED A CIRCUMSTANCE FOR ADDITIONAL TIME OR COMPENSATION.

2. THE CONTRACTOR SHALL CONFINE ALL OPERATIONS, INCLUDING EQUIPMENT AND MATERIAL STORAGE, WITHIN THE CONSTRUCTION AREAS SHOWN IN THE PLANS.

3. THE CONTRACTOR SHALL CONTROL CONSTRUCTION DEBRIS AND HAZARDOUS WASTE SPILLS. THE CONTRACTOR SHALL CLEAN-UP AND DISPOSE OF ALL WASTE PROPERLY OFF-SITE AT AN APPROVED DISPOSAL FACILITY. NO CONSTRUCTION MATERIAL WASTES OR UNUSED MATERIALS SHALL BE BURIED, DUMPED, BURNED, OR DISCHARGED WITHIN THE PROJECT LIMITS.

4. THE CONTRACTOR SHALL TAKE STEPS TO CONTROL SOIL EROSION. IF NECESSARY, HAY BALES, CHECK DAMS, SEDIMENT TRAPS OR ADDITIONAL SILT FENCE (NOT INDICATED ON THE PLANS) SHALL BE USED TO RETAIN SILT AND PREVENT SILT FROM ENTERING THE MISSISSIPPI RIVER. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO CONDUCT OPERATIONS IN ACCORDANCE WITH THE POLLUTION PREVENTION PLAN AND ADMINISTER IT THROUGHOUT THE PROJECT DURATION.

5. THE CONTRACTOR SHALL TAKE STEPS TO CONTROL FUGITIVE DUST DURING CONSTRUCTION. AT A MINIMUM, THE CONTRACTOR SHALL APPLY WATER TO ALL WORK AREA ROADS DAILY WHEN RAIN IS NOT IMMINENT.

hgm
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PHONE: (712) 323-0530

LAL drawn
BJR designed
TLS approved
FEB '11 date
revision
date

project RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND EMBANKMENT IMPROVEMENTS
client MIDAMERICAN ENERGY COMPANY
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501
sheet TYPICAL SECTION/GENERAL NOTES

project no.
112510A
sheet
B.01

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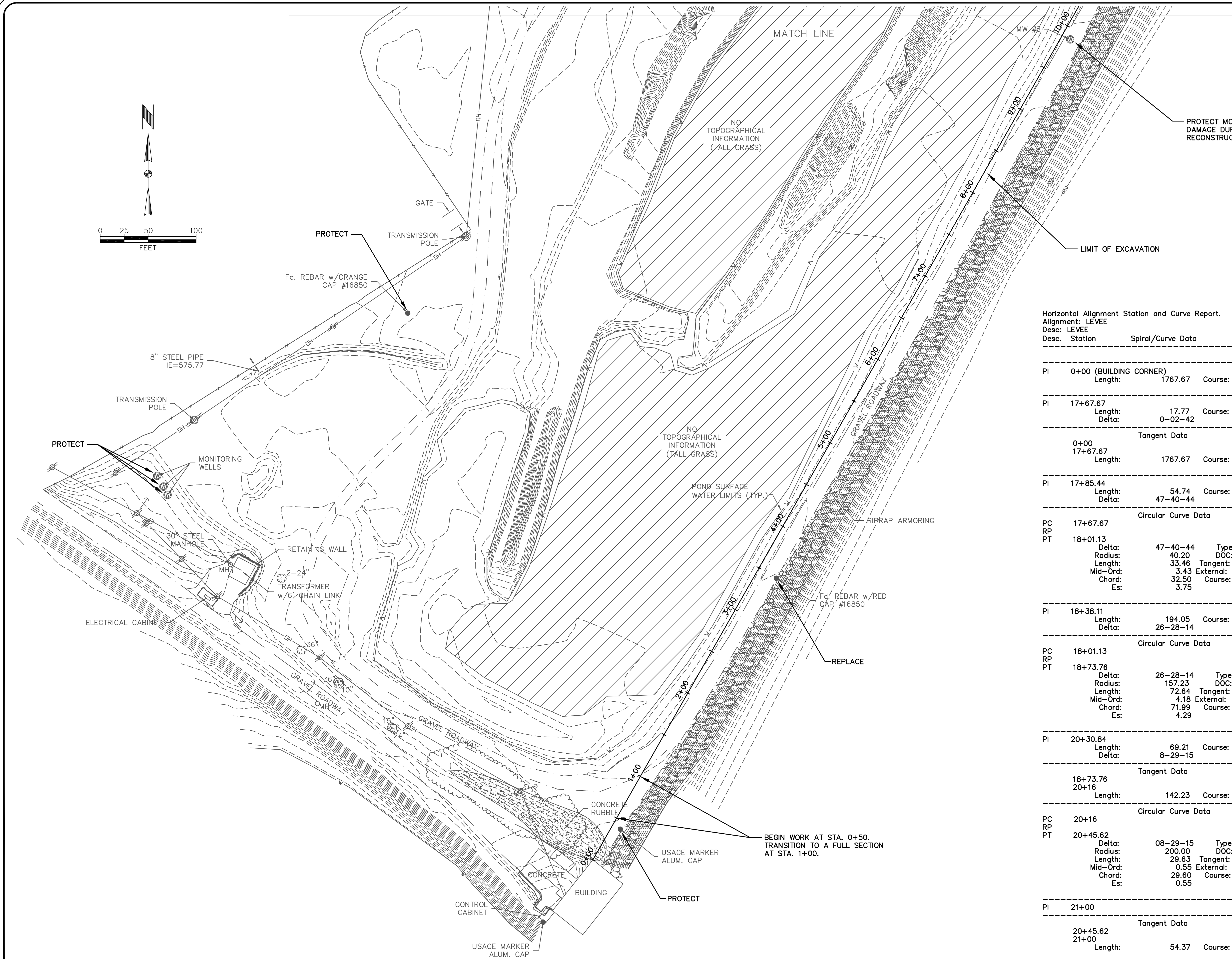


```
Horizontal Alignment Station and Curve Report.
Alignment:  LEVEE
Desc:  LEVEE
Desc.  Station          Spiral/Curve Data              Northing          Easting
---------------------------------------------------------------------------------

---------------------------------------------------------------------------------
PI     0+00 (BUILDING CORNER)                          573280.41         2474375.55
            Length:              1767.67    Course:    N 29-39-02 E

---------------------------------------------------------------------------------
PI     17+67.67                                        574816.62         2475250.03
            Length:                17.77    Course:    N 29-36-20 E
             Delta:             0-02-42
---------------------------------------------------------------------------------
                           Tangent Data
       0+00                                             573280.41         2474375.55
       17+67.67                                        574816.62         2475250.03
            Length:              1767.67    Course:    N 29-39-02 E

---------------------------------------------------------------------------------
PI     17+85.44                                        574832.07         2475258.80
            Length:                54.74    Course:    N 18-04-24 W
             Delta:            47-40-44
---------------------------------------------------------------------------------
                           Circular Curve Data
PC     17+67.67                                         574816.62         2475250.03
RP                                                      574836.48         2475215.07
PT     18+01.13                                        574848.96         2475253.29
             Delta:            47-40-44        Type:           LEFT
            Radius:               40.20         DOC:      142-30-39
            Length:               33.46    Tangent:           17.77
          Mid-Ord:                 3.43   External:            3.75
             Chord:               32.50     Course:    N 05-45-58 E
                Es:                3.75

---------------------------------------------------------------------------------
PI     18+38.11                                        574884.11         2475241.82
            Length:               194.05    Course:    N 44-32-39 W
             Delta:            26-28-14
---------------------------------------------------------------------------------
                           Circular Curve Data
PC     18+01.13                                        574848.96         2475253.29
RP                                                      574800.18         2475103.82
PT     18+73.76                                        574910.47         2475215.88
             Delta:            26-28-14        Type:           LEFT
            Radius:              157.23         DOC:       36-26-30
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             Chord:               71.99     Course:    N 31-18-32 W
                Es:                4.29

---------------------------------------------------------------------------------
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             Delta:             8-29-15
---------------------------------------------------------------------------------
                           Tangent Data
       18+73.76                                        574910.47         2475215.88
       20+16                                           575011.84         2475116.11
            Length:               142.23    Course:    N 44-32-39 W
---------------------------------------------------------------------------------
                           Circular Curve Data
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RP                                                      574871.55         2474973.57
PT     20+45.62                                        575031.34         2475093.84
             Delta:            08-29-15        Type:           LEFT
            Radius:              200.00         DOC:       28-38-52
            Length:               29.63    Tangent:           14.84
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             Chord:               29.60     Course:    N 48-47-16 W
                Es:                0.55

---------------------------------------------------------------------------------
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---------------------------------------------------------------------------------
                           Tangent Data
       20+45.62                                        575031.34         2475093.84
       21+00                                           575064.04         2475050.40
            Length:                54.37    Course:    N 53-01-54 W
```


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LAL	drawn
BJR	designed
TLS	approved
FEB.'11	date
revision	date

project RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND EMBANKMENT IMPROVEMENTS

client MIDAMERICAN ENERGY COMPANY
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501

sheet **EMBANKMENT IMPROVEMENTS PLAN**

project no.
112510A
sheet
D.01

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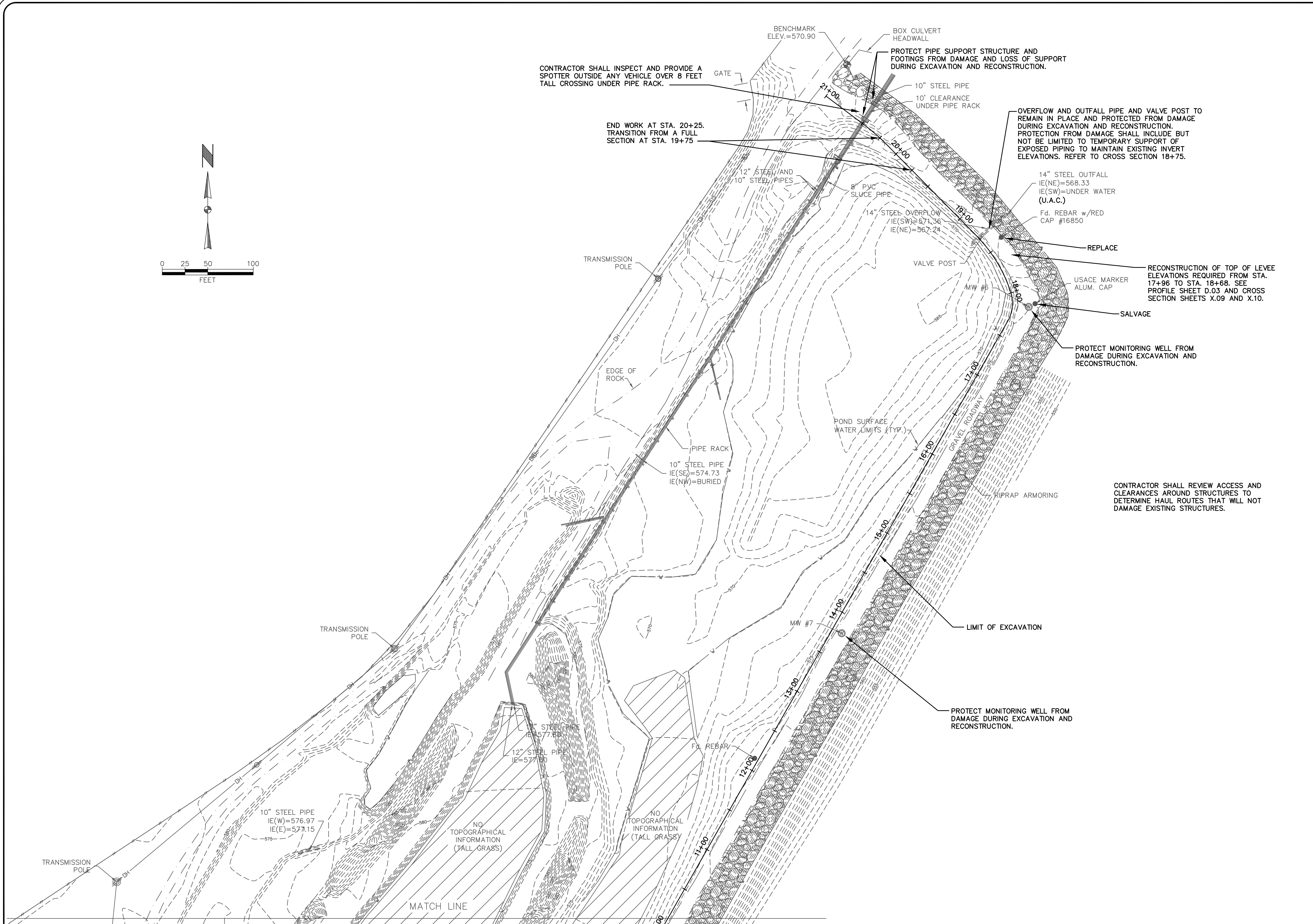

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LAL drawn
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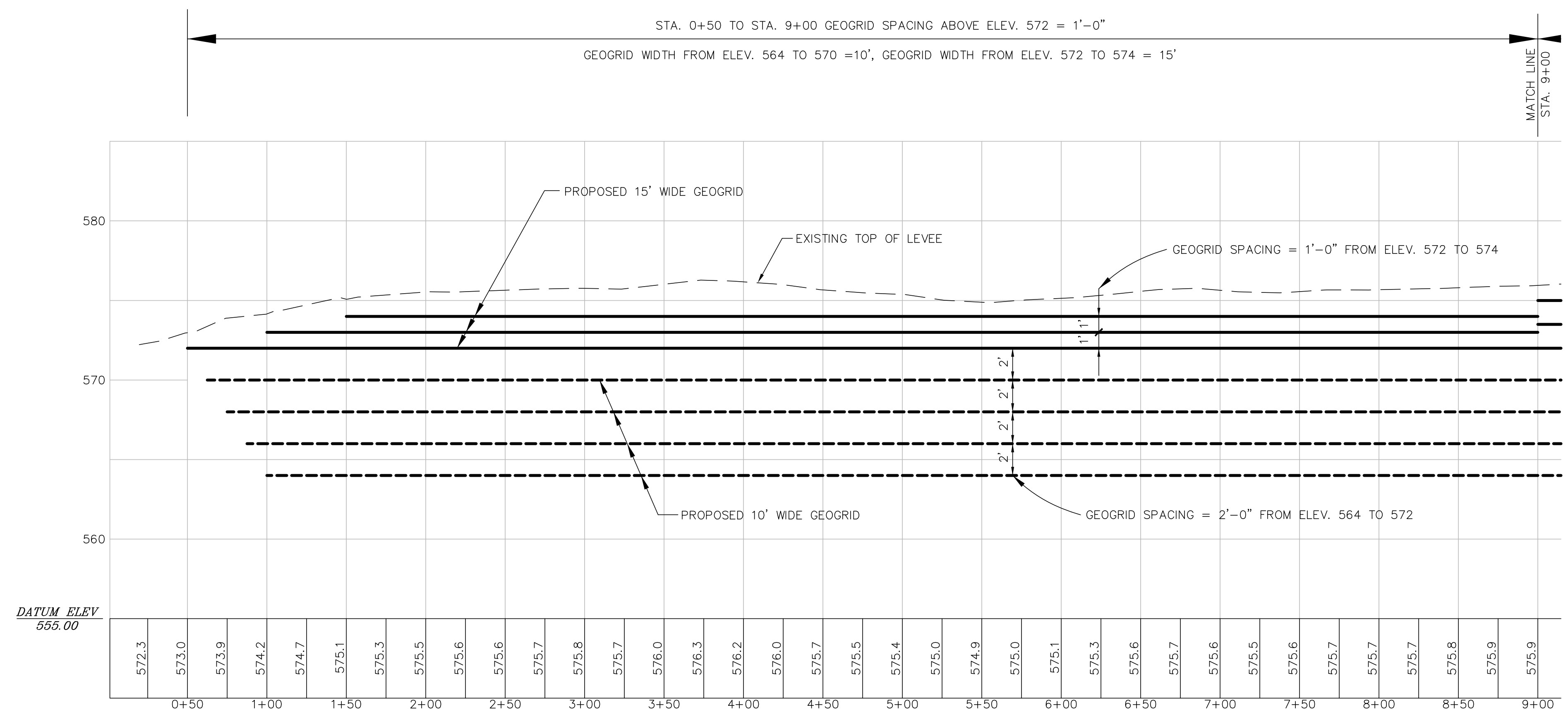
project RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND EMBANKMENT IMPROVEMENTS

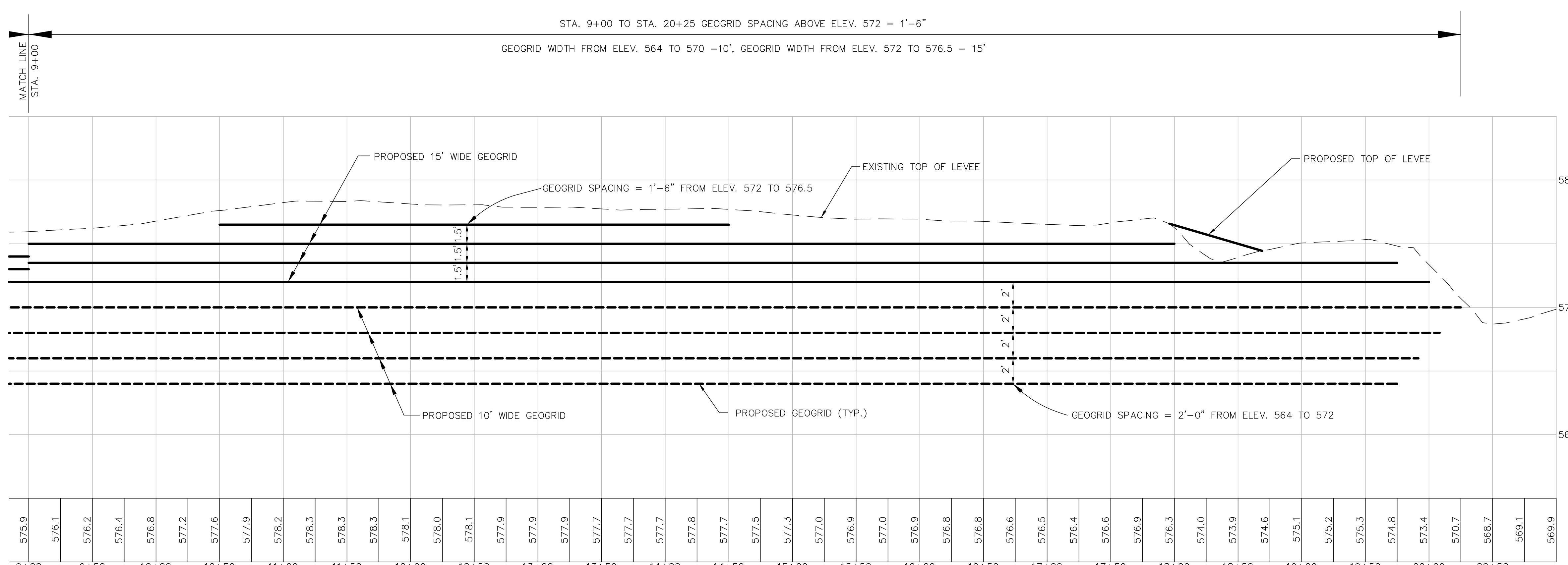
client MIDAMERICAN ENERGY COMPANY
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501

sheet **EMBANKMENT IMPROVEMENTS PLAN**

project no. 112510A

sheet **D.02**





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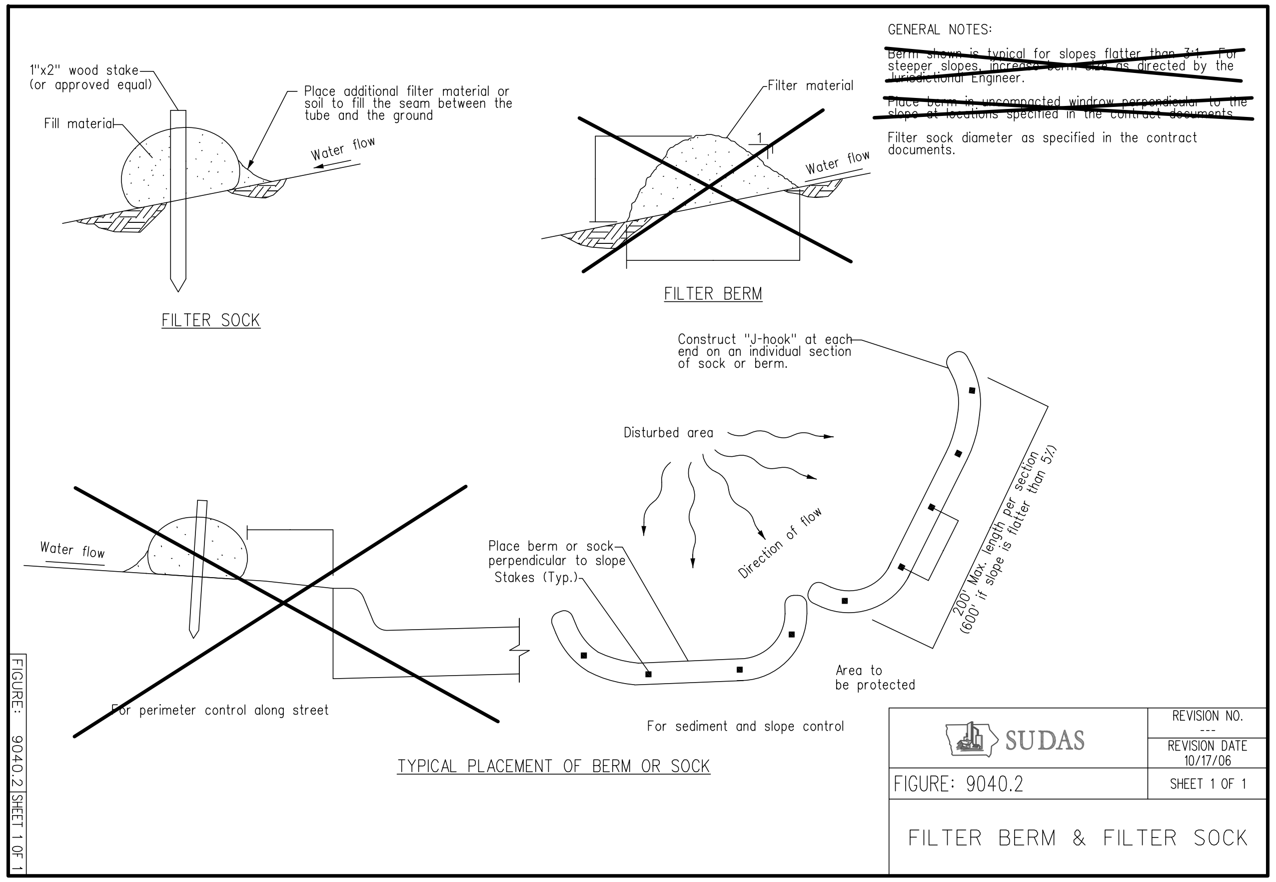
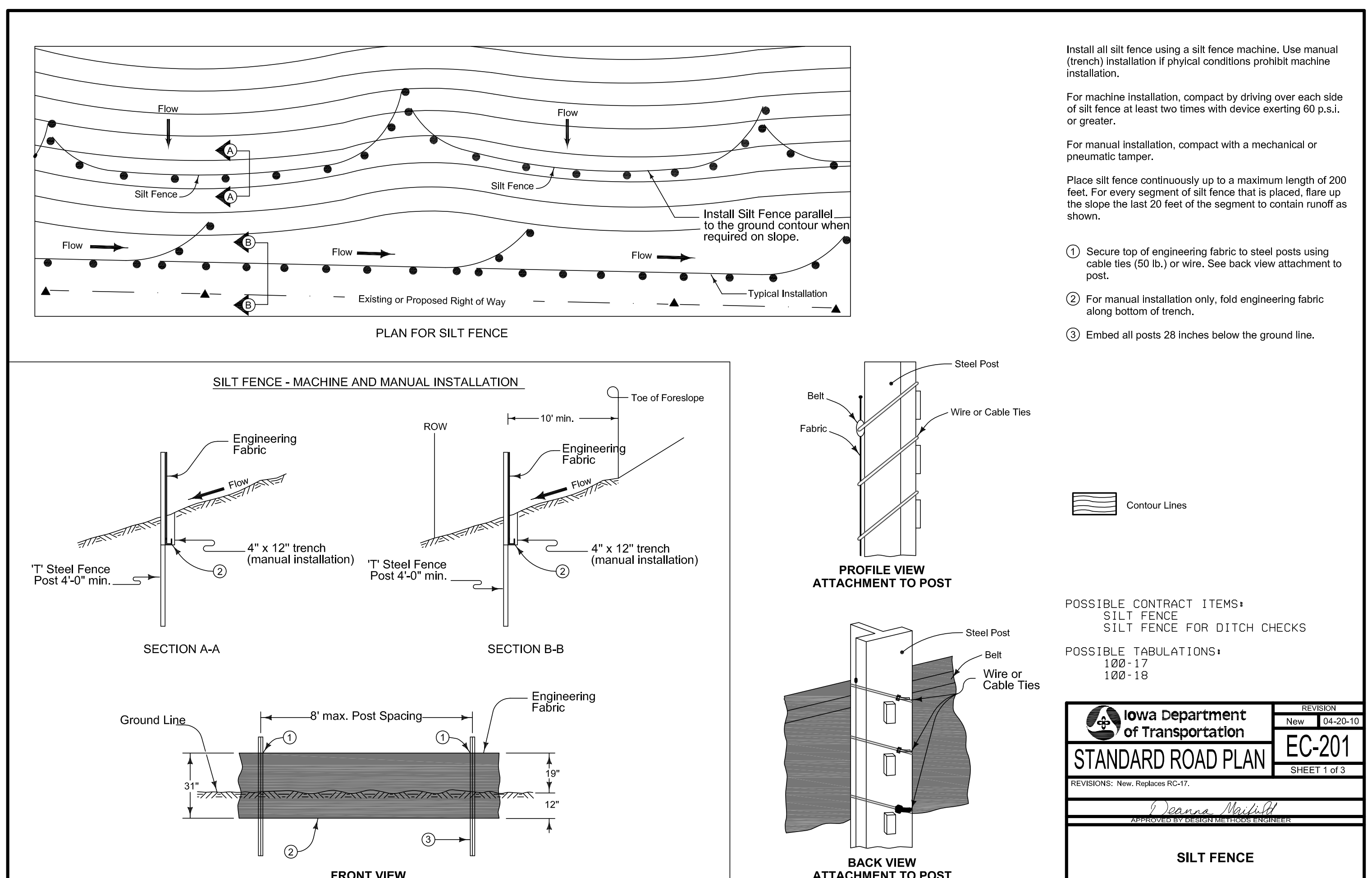
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501

sheet **EMBANKMENT IMPROVEMENTS PLAN**

project no. 112510A

sheet **D.03**





IOWA NPDES GENERAL PERMIT NO. 2

Storm Water Pollution Plan
Construction/Implementation
CHECKLIST

Maintain Records of Construction Activities, including:
- Dates when major grading activities occur
- Dates when construction activities temporarily cease on a portion of the site
- Dates when construction activities permanently cease on a portion of the site
- Dates when stabilization measures are initiated on the site

Prepare Inspection Reports summarizing:
- Name of Inspector
- Qualifications of inspector
- Measures/areas inspected
- Observed conditions
- Change necessary to the storm water pollution prevention plan

Report any "Hazardous Conditions":
- Notify the IDNR and sheriff's office not less than six hours after the onset of a "hazardous condition"
- Modify the pollution prevention plan to include:
  - the date of release
  - circumstances leading to the release
  - steps taken to prevent reoccurrence of the release

Modify Pollution Prevention Plan as necessary to:
- Comply with minimum permit requirements when notified by the IDNR that the plan does not comply
- Address a change in design, construction operation or maintenance which has an effect on the potential for discharge of pollutants
- Prevent reoccurrence of a "hazardous condition"

IMPLEMENTATION PLAN

CONSTRUCTION ACTIVITY	STABILIZATION
REMOVAL OF EXISTING RIP-RAP AND GRAVEL BEDDING	INSTALL FILTER SOCK ALONG RIVER BANK
REMOVAL OF EXISTING BANK MATERIAL	MAINTAIN FILTER SOCK
CONSTRUCT GEOGRID REINFORCED EMBANKEMENT AND ROCK SURFACING	MAINTAIN FILTER SOCK
REPLACEMENT OF GRAVEL BEDDING AND RIP-RAP	REMOVE FILTER SOCK
FINAL STABILIZATION	RESTORATION/SEEDING OF STOCKPILE LOCATION AND EMBANKEMENT BACKSLOPE

SEQUENCE OF MAJOR ACTIVITIES

APRIL-JUNE 2011	EMBANKEMENT IMPROVEMENTS

hgm ASSOCIATES INC.
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FEB. '11 date

project RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND EMBANKMENT IMPROVEMENTS
client MIDAMERICAN ENERGY COMPANY
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501
sheet POLLUTION PREVENTION PLAN

project no. 112510A
sheet E.01

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Native Grass Seeding and Mulching
Conform to Iowa DOT Article 2601.

Silt Fence
A. Materials
Use silt fence that meets the following requirements:
1. Fabric: Conform to Iowa DOT Article 4196.01.
2. Posts: 4 foot minimum steel (T-section) weighing at least 1.25 pounds per foot, exclusive of anchor plate. Painted posts are not required.
3. Fastener: Wire or plastic ties with a minimum tensile strength of 50 pounds.

B. Installation:
1. Install material along the contour of the ground, as specified in the contract documents, or as directed by the Engineer.
2. Install silt fence with a mechanical soil slicing machine that creates a slit in the ground while simultaneously installing the fabric. The trenching method may be used when situations will not allow soil slicing, as determined by the Engineer.
3. Construct a "J-hook" at each end of a continuous run of silt fence, by turning the end of the silt fence uphill, as necessary to prevent runoff from flowing around ends when water behind the fence ponds to a level even with the top of the fence.
4. Insert 12 inches of fabric to a minimum depth of 6 inches (fabric may be folded below the ground line).
5. Compact installation by driving along each side of the silt fence, or by other means, as necessary to adequately anchor the material in the ground, to prevent pullout and water flow under the fence.
6. Drive steel posts into the ground alongside the silt fence, to a minimum depth of 20 inches, unless otherwise specified by the Engineer. Space posts as shown on Figure 9040.19, or as required to adequately support silt fence.

C. Maintenance: At the Contractor's expense, repair or replace non-functioning silt fence that allows water to flow under the fence, is torn, or is otherwise damaged, due to inadequate installation.

D. Removal:
1. Remove the silt fence upon final stabilization of the project area, or according to the staging indicated in the SWPPP.
2. Remove and dispose of silt fence and posts.
3. Remove sediment or spread to match finished grade; ensure proper drainage.
4. Stabilize the area disturbed by removal operations.

E. Replacement:
1. When accumulated sediment reaches a level one-half the height of the fence, remove the silt fence as described above, and replace according to the installation instructions above.
2. At the Engineer's option, the existing silt fence and accumulated sediment may be left in place, and a new silt fence installed up-slope from the existing silt fence.
3. When permitted by the Engineer, the existing silt fence may be left in place and the accumulated sediment removed. Carefully inspect the existing silt fence for structural integrity and signs of undermining. Make any necessary repairs.

Filter Socks
A. Filter Material
1. Use material derived from wood, bark, or other, non-toxic vegetative feedstocks.
2. Use material with no visible admixture of refuse or other physical contaminants, nor any material toxic to plant growth.
3. Use material meeting the following particle sizes:

Sieve Size	Percent Passing
2"	100
1"	90-100
⅜"	0-30
The target flow rate of in-place material is 10 gal/min/lf. The Engineer may approve use of alternate materials meeting the target flow rate.	

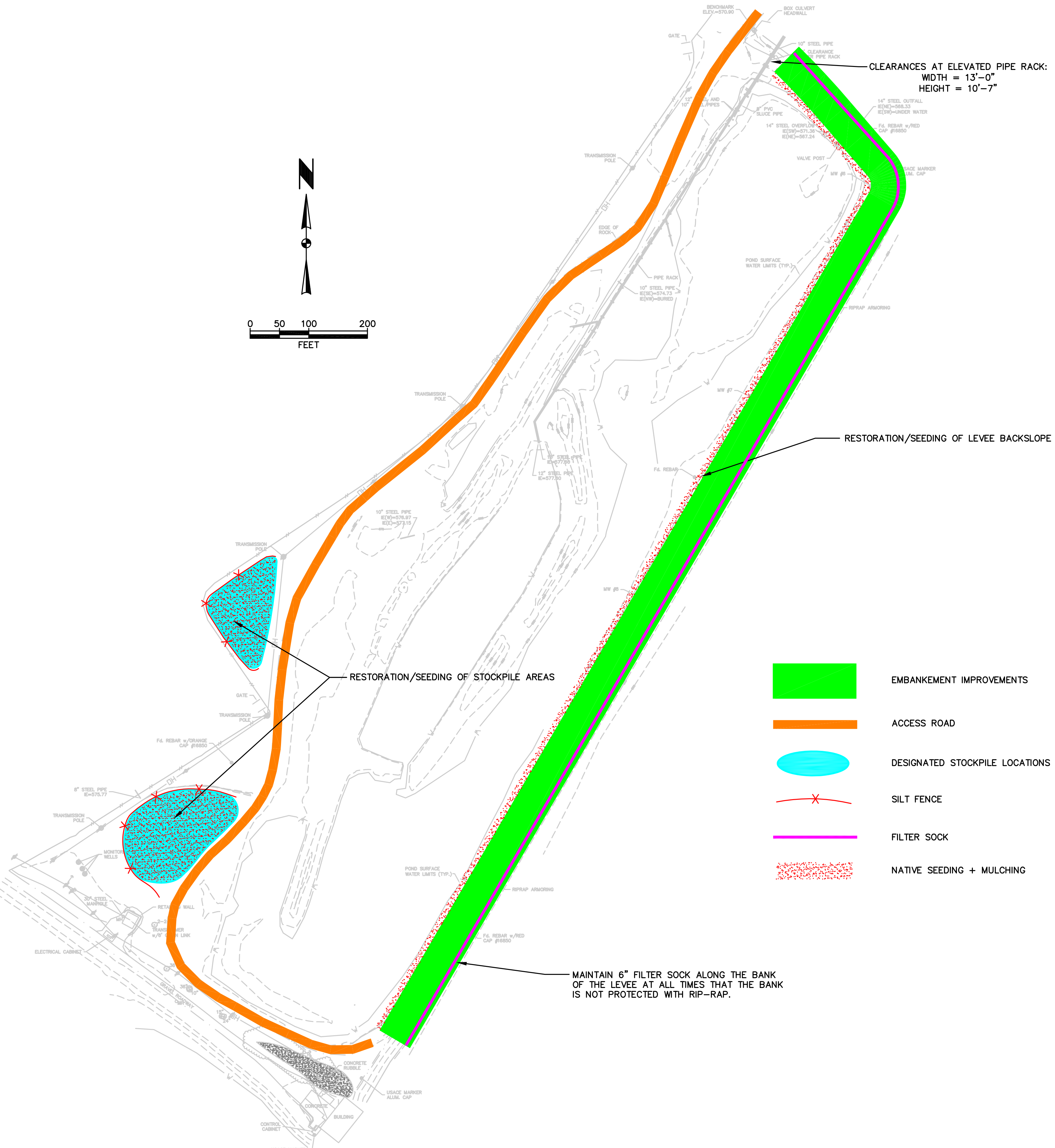
B. Sock Material
1. For slope and sediment control applications, use a continuous, tubular, knitted, mesh netting with 3/8 inch openings, constructed of 5-mil thickness, photodegradable HDPE.
2. For inlet protection, use a continuous, tubular, knitted, mesh netting with 3/8 inch openings, constructed of 500-denier polypropylene.
3. Use 1 inch by 2 inch (minimum) hardwood stakes or stakes of equivalent strength.

C. Installation:
1. Pneumatically fill mesh filter sock of size and length indicated in the contract documents, or as directed by the Engineer. Alternative methods of filling the sock may be allowed upon approval of the Engineer.
2. Fill socks with filter material.
3. Place the filter sock along the contour as specified in the contract documents, or as directed by the Engineer.
4. Place additional filter material or soil from the site, on the upstream side of the sock, in the seam between the tube and the ground.
5. Construct a "J-hook" at each end of a continuous run of filter sock, by turning the end of the sock uphill, as necessary to prevent runoff from flowing around the ends when water behind the sock ponds up to a level even with the top of the sock.
6. Drive stakes into the ground at a maximum spacing of 10 feet, and as required to secure the sock and prevent movement.
7. Construct according to Figure 9040.2 for perimeter control and sediment control on Grade

D. Maintenance: Perform the following incidental work.
1. Repair or replace non-functioning filter socks that allow water to flow under the sock, are torn, or are otherwise damaged, due to inadequate installation.
2. Remove filter material from damaged socks that are located along streambanks, around intakes, in ditches, or in other locations where the material may be carried to surface waters.

E. Removal: When indicated in the contract documents, or as directed by the Engineer; remove the filter sock upon completion of the project, and after final stabilization is achieved; or as indicated in the SWPPP, if applicable.
1. Upon completion of the project, completely remove socks and filter material that are located along streambanks, around intakes, in ditches, or in other locations where the filter material may be carried to surface waters if the sock degrades and/or tears.
2. Slice the sock longitudinally. Remove and dispose of the filter sock material and stakes.
3. Spread the filter material and accumulated sediment to match finished grade and to ensure proper drainage.
4. If the site has been brought to finished grade and prepared for permanent seeding, spread and incorporate the filter material into the surface by tilling, or as required to break up any large particles and provide a finished surface suitable for permanent seeding.

F. Replacement:
1. When accumulated sediment reaches a level one-half the height of the sock, or when the sock becomes clogged with sediment and no longer allows runoff to flow through, remove the sock as described above, and replace according to the installation instructions above.
2. At the Engineer's option, the existing filter sock and accumulated sediment may be left in place, and a new filter sock installed up-slope from the existing filter sock.



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LAL drawn
BJR designed
TLS approved
FEB '11 date

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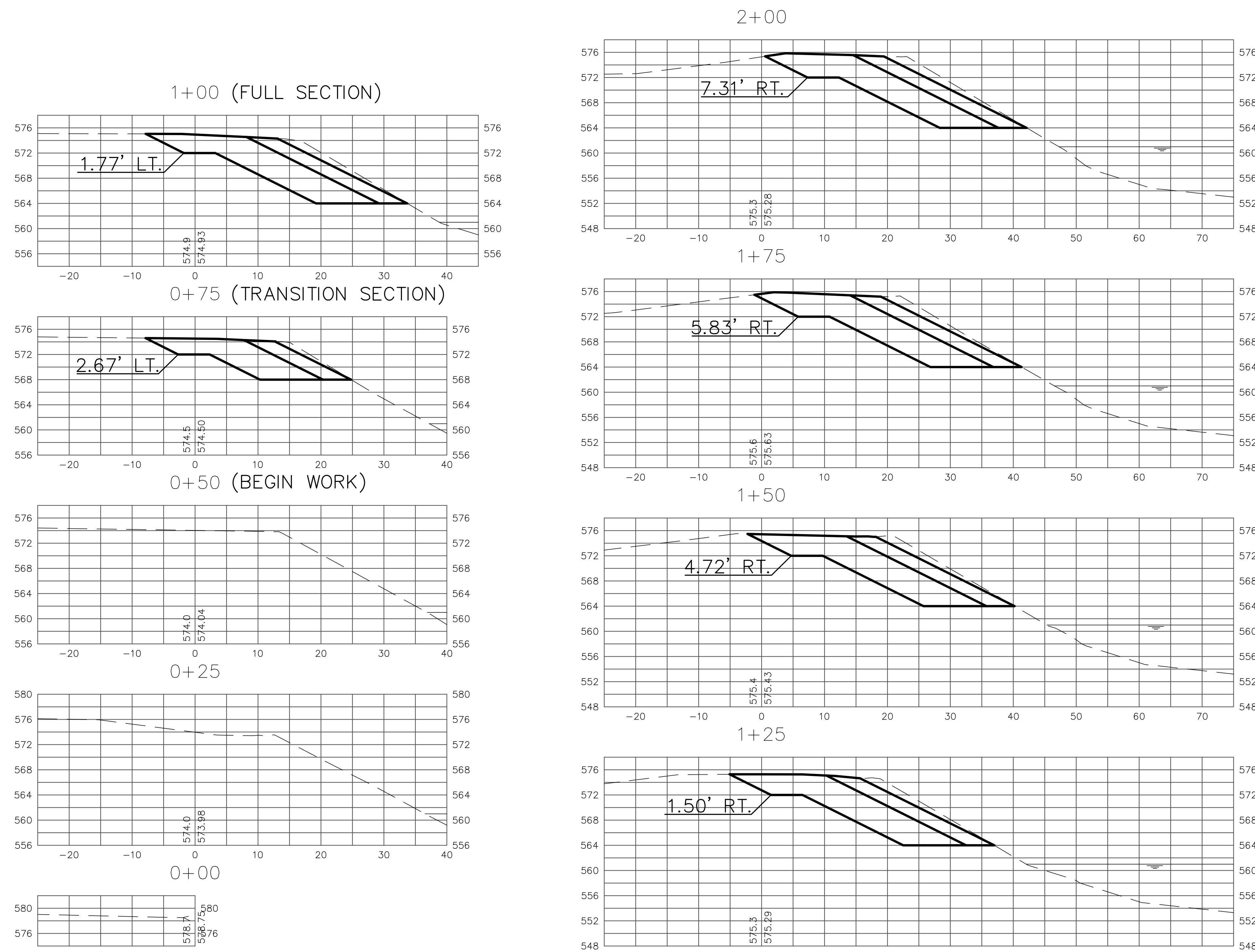
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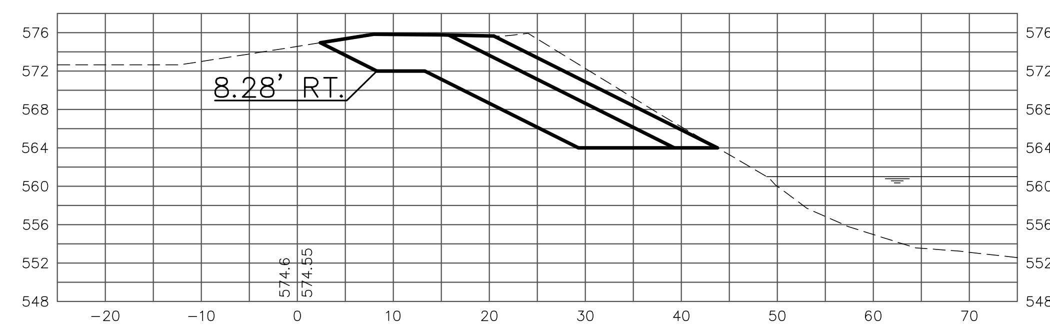

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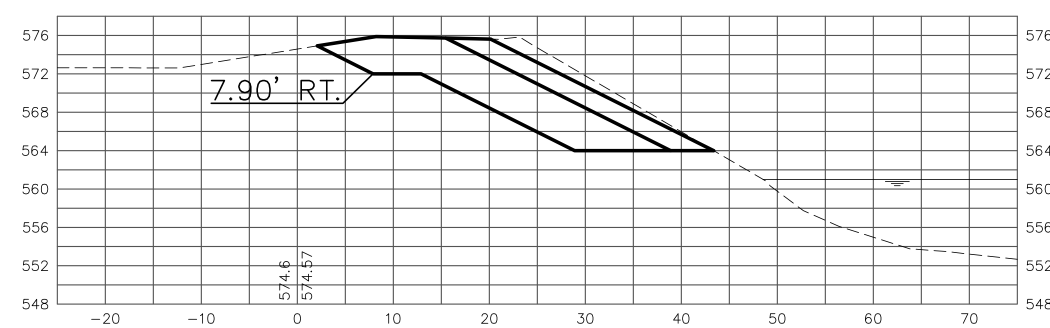

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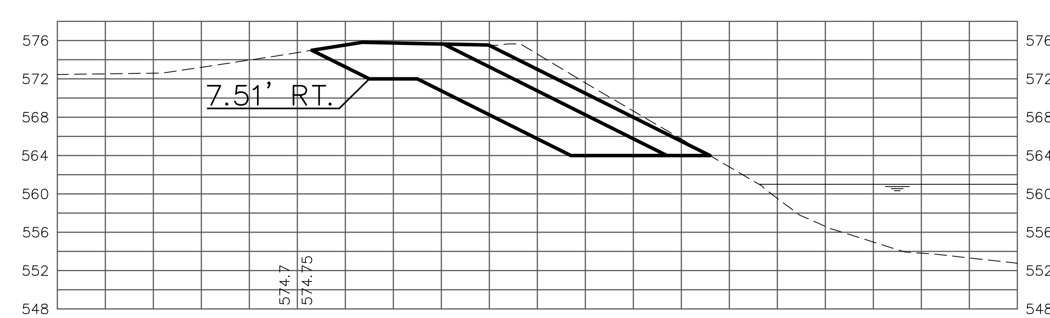

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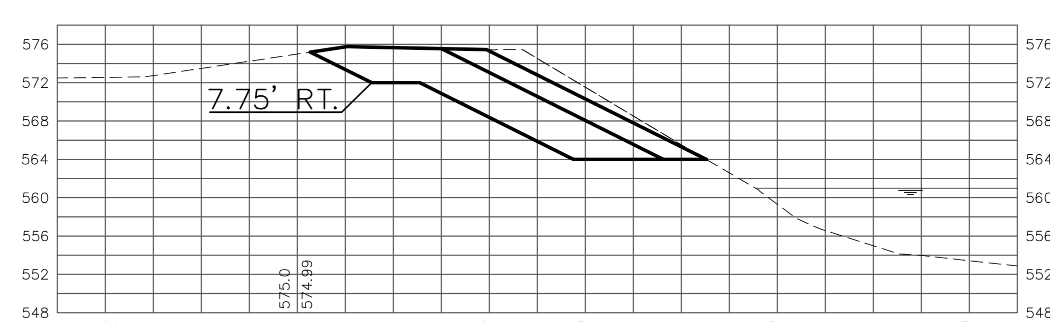

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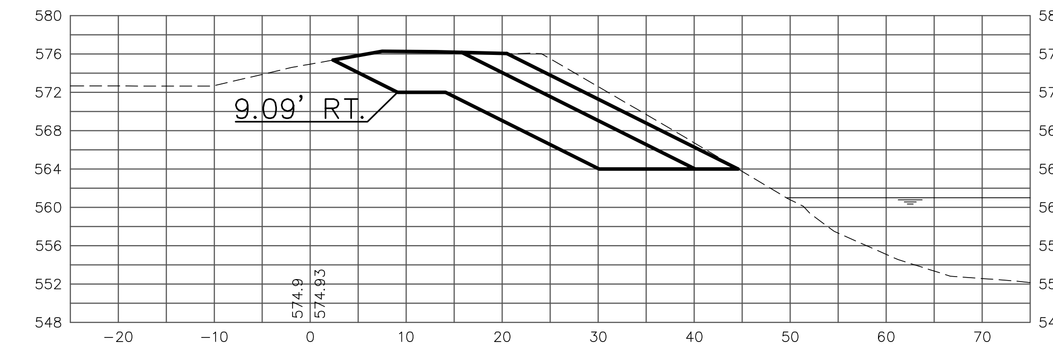

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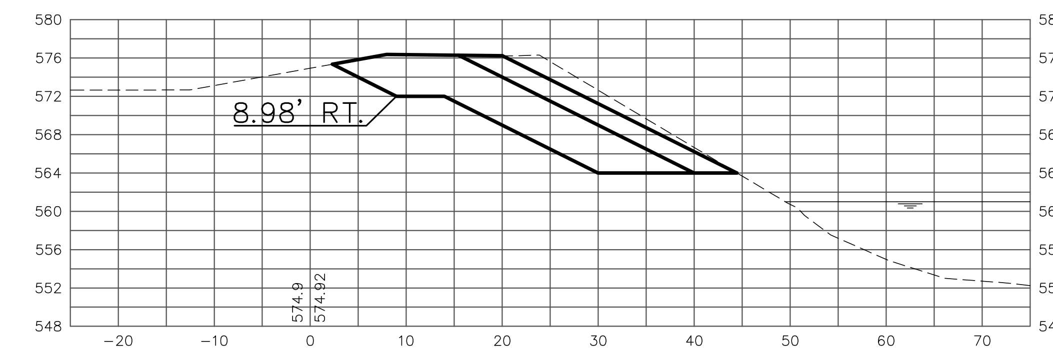

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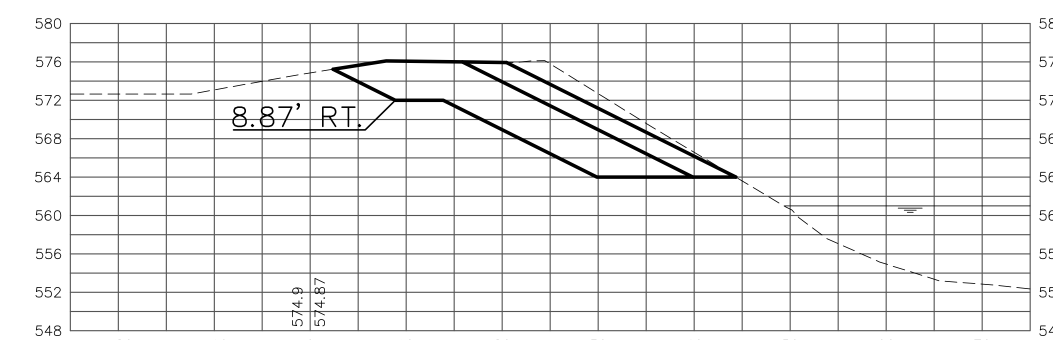

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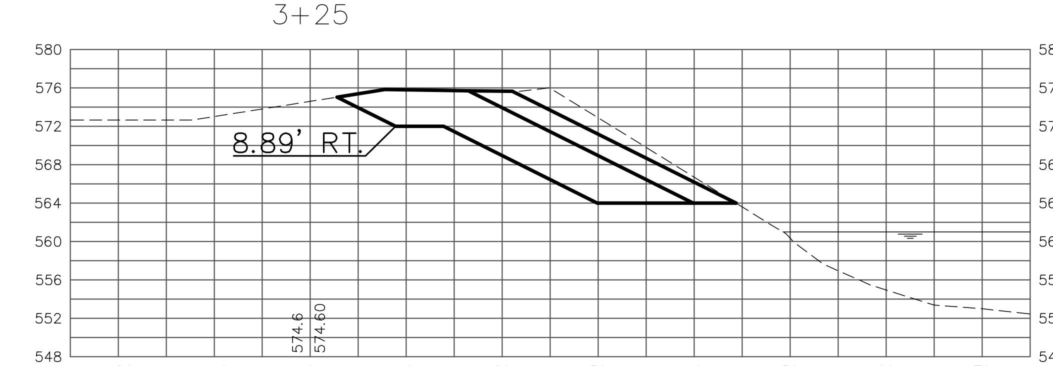

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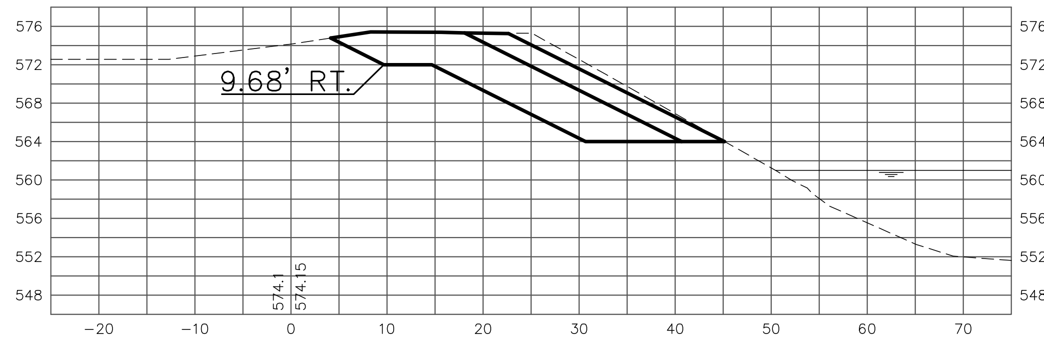

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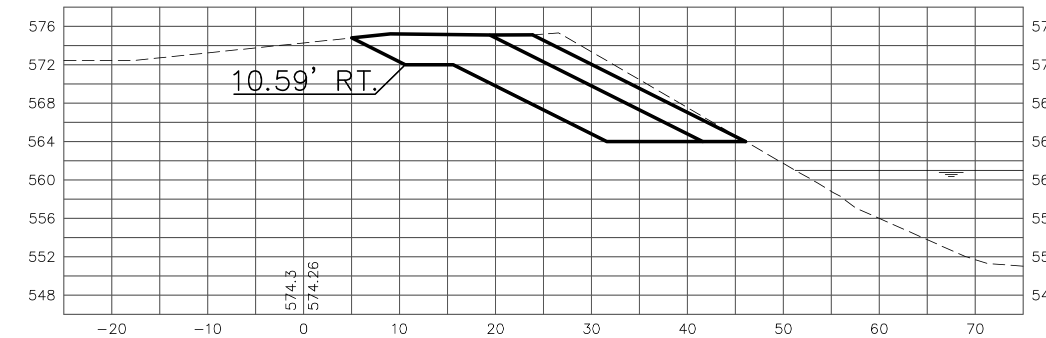

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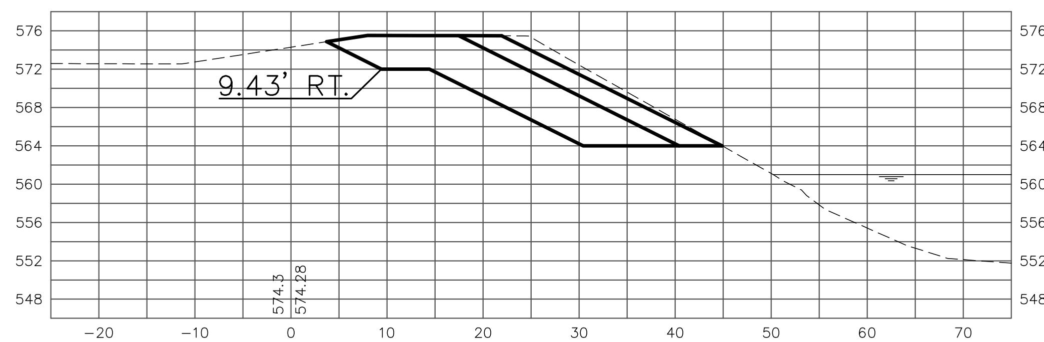

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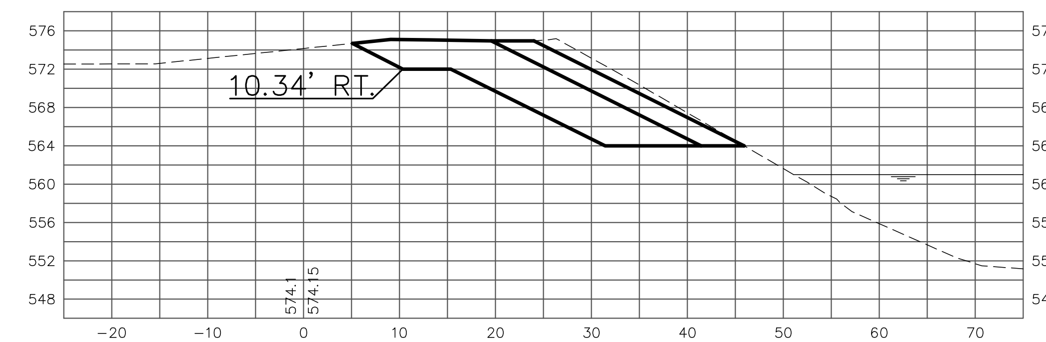

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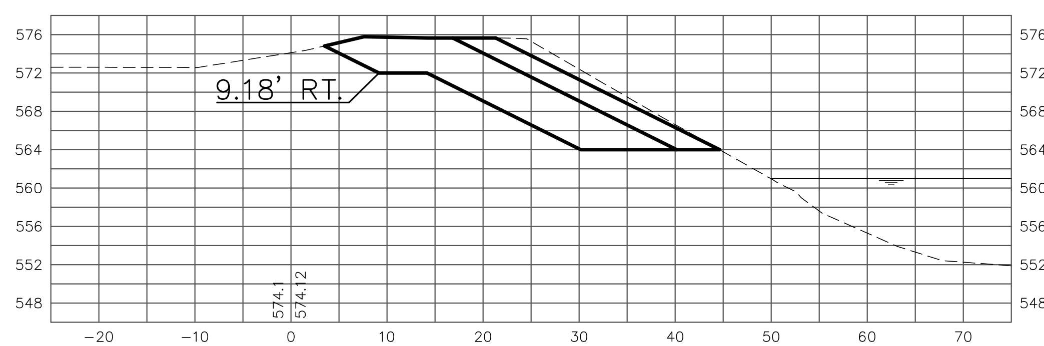

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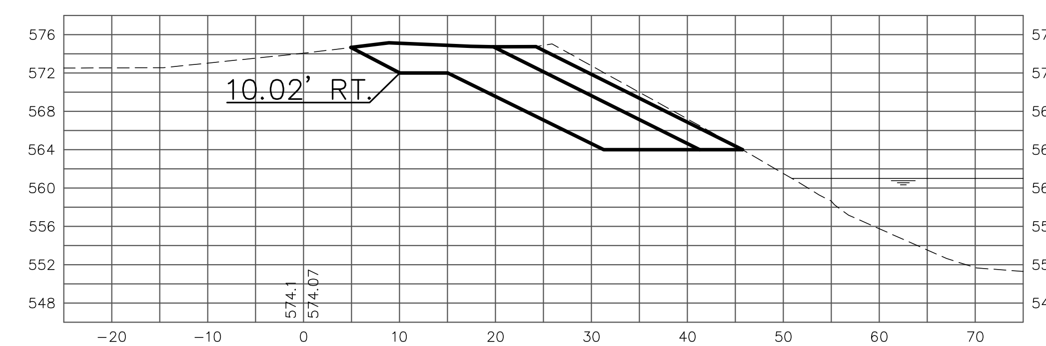

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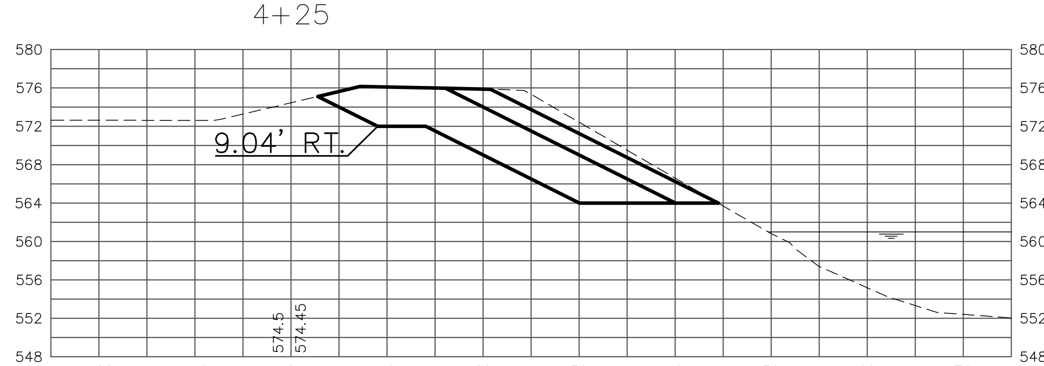

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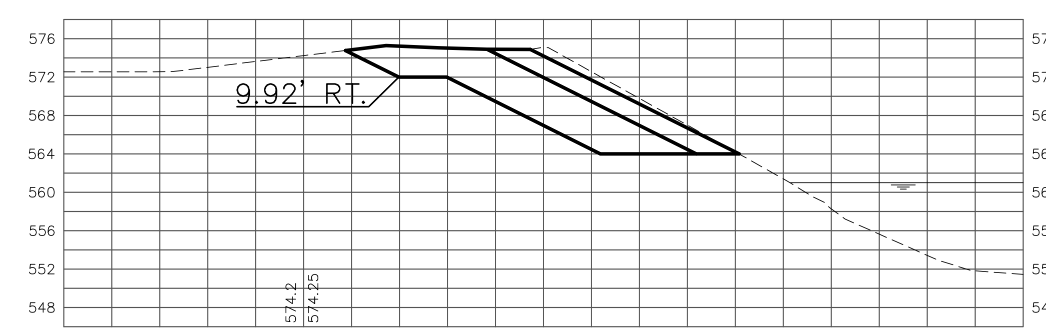

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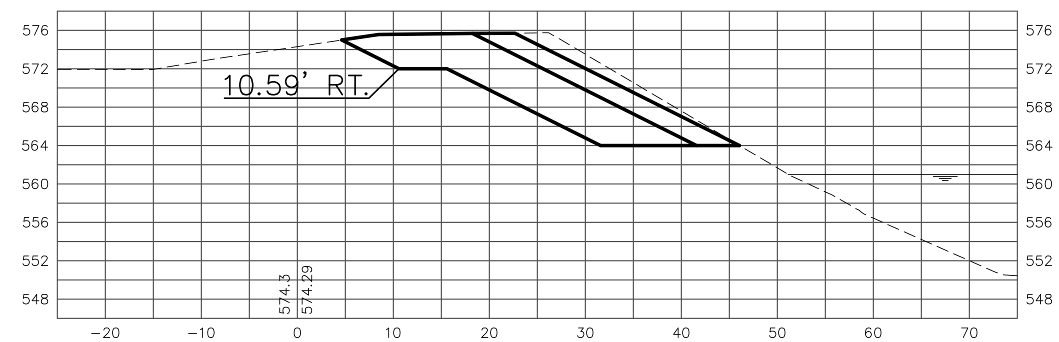

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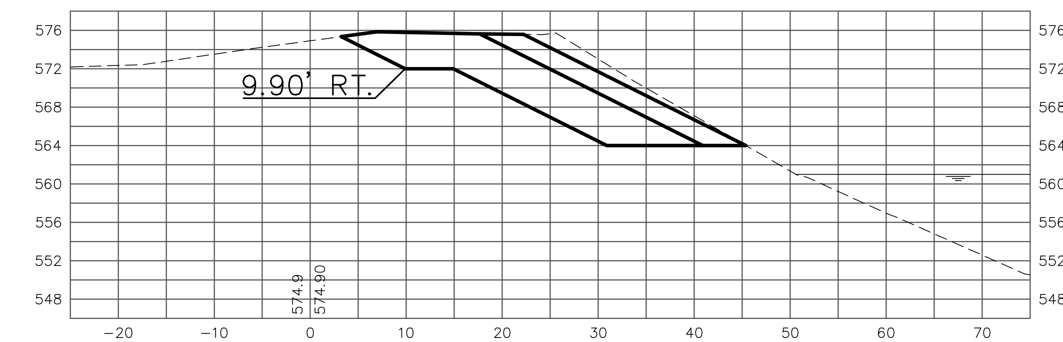

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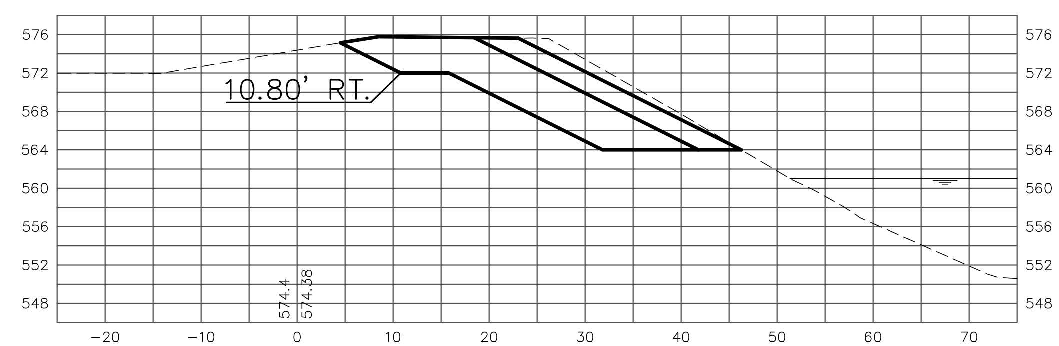

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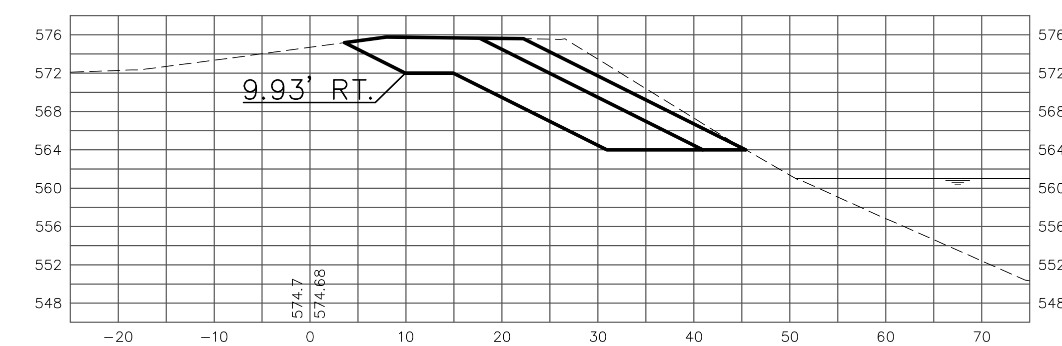

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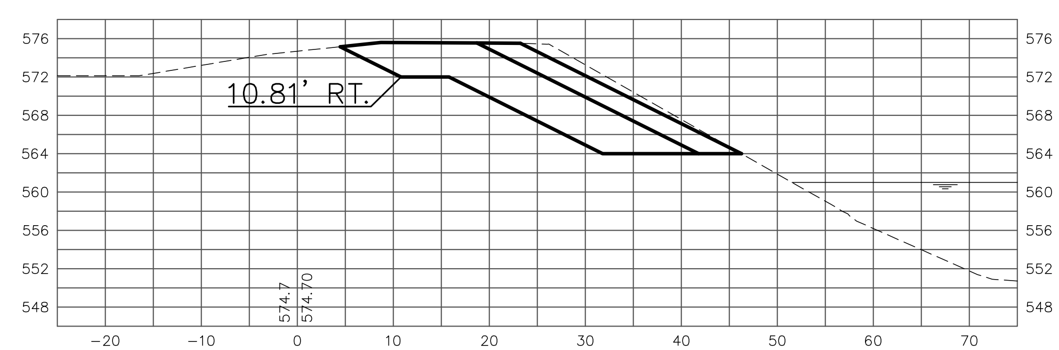

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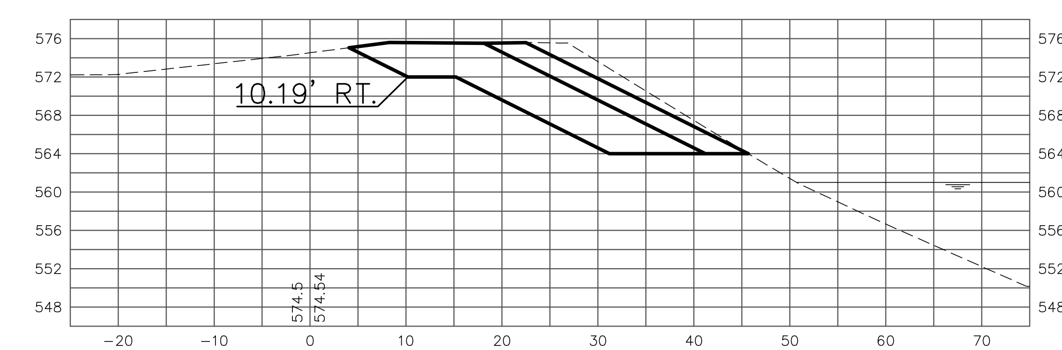

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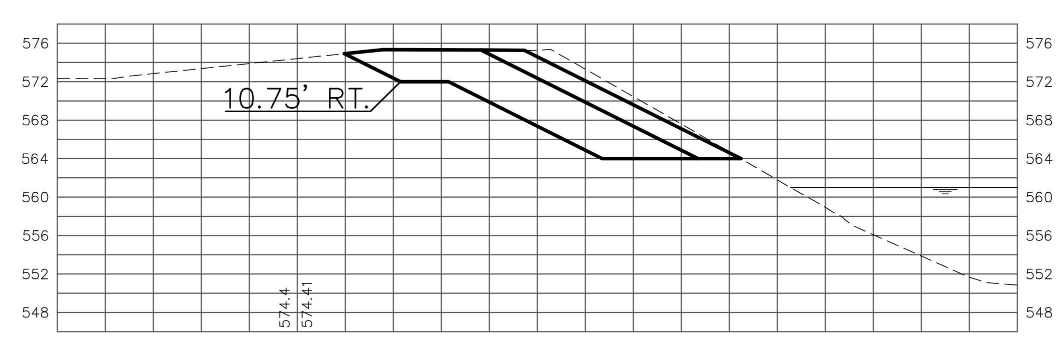

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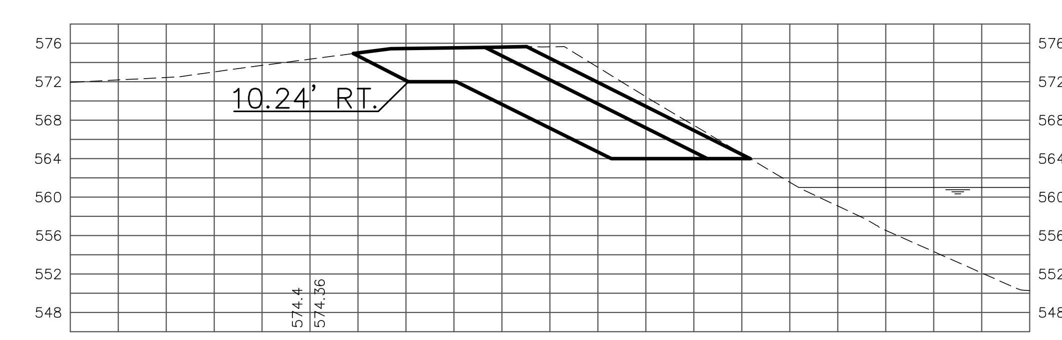

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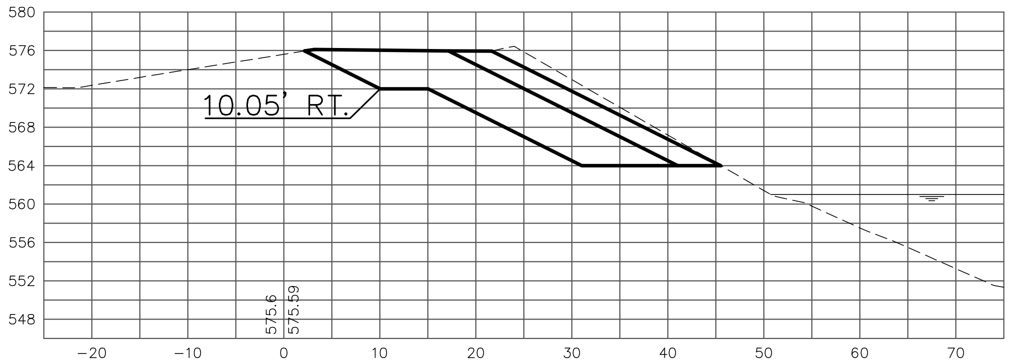

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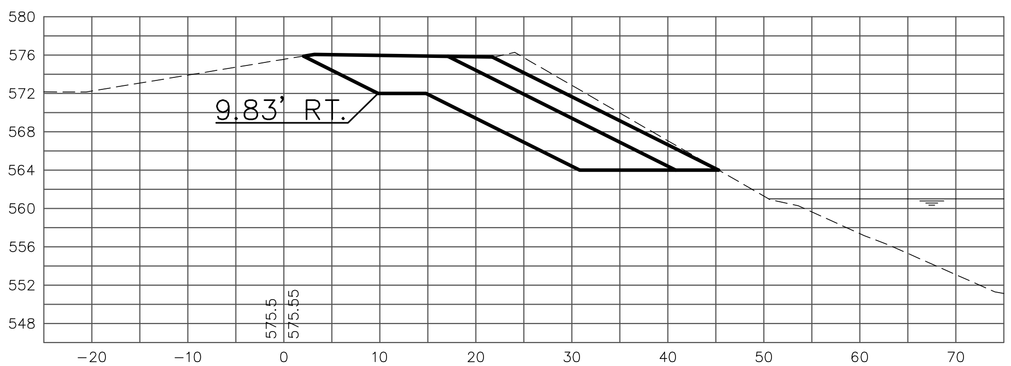

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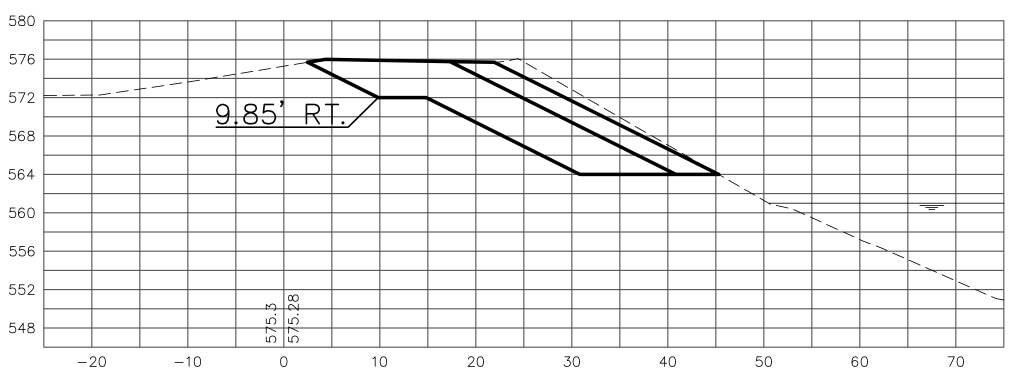

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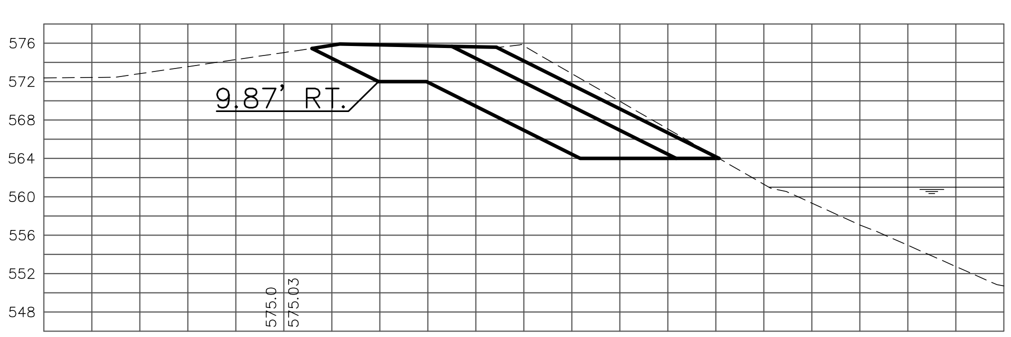

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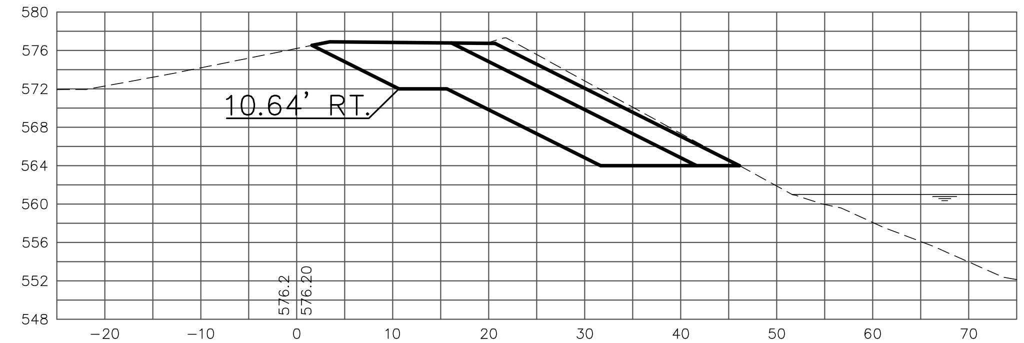

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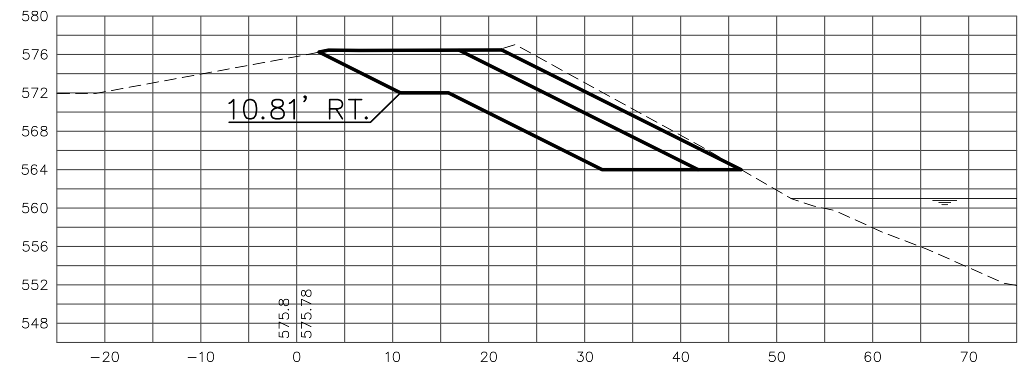

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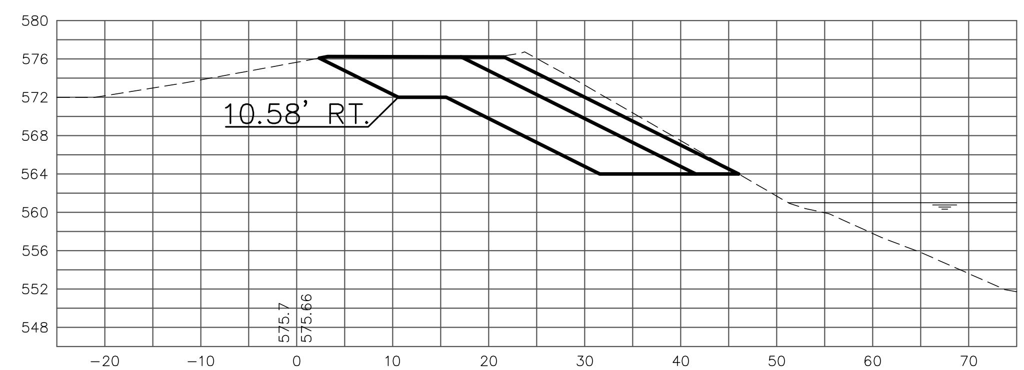

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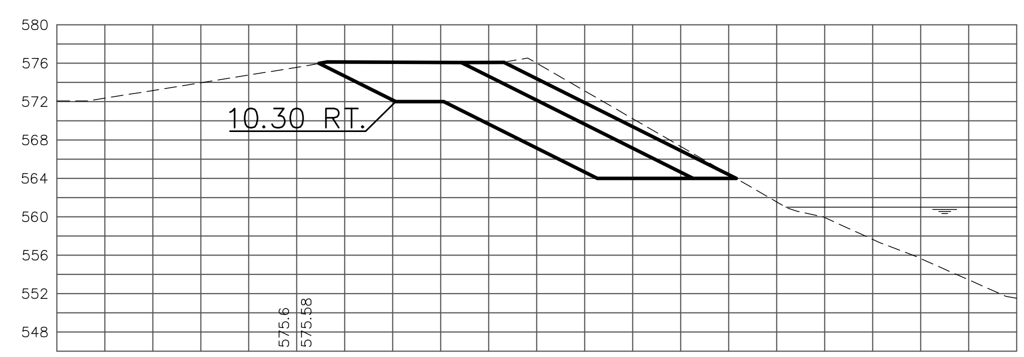

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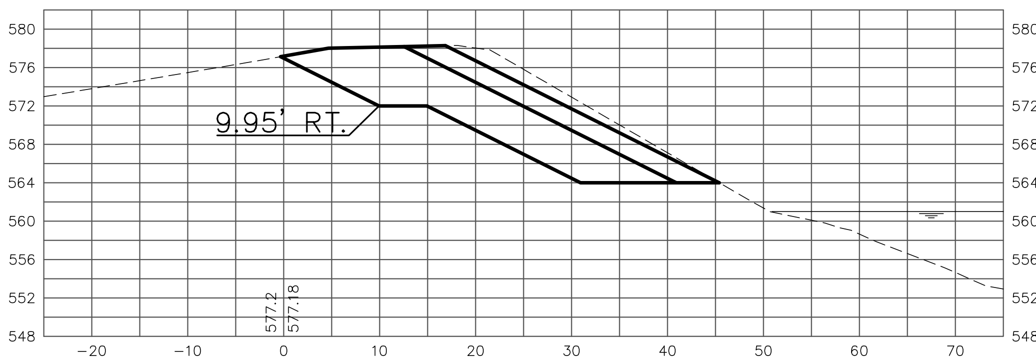

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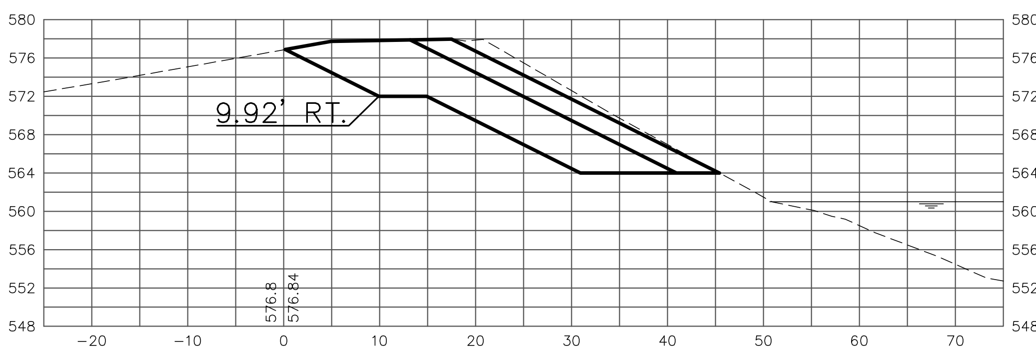

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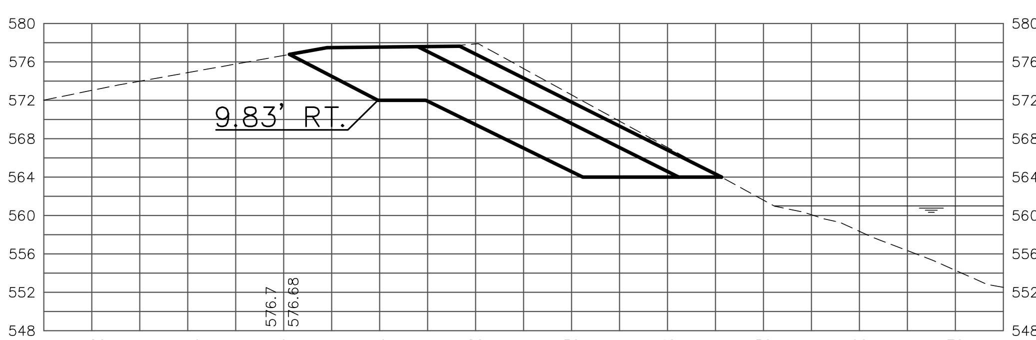

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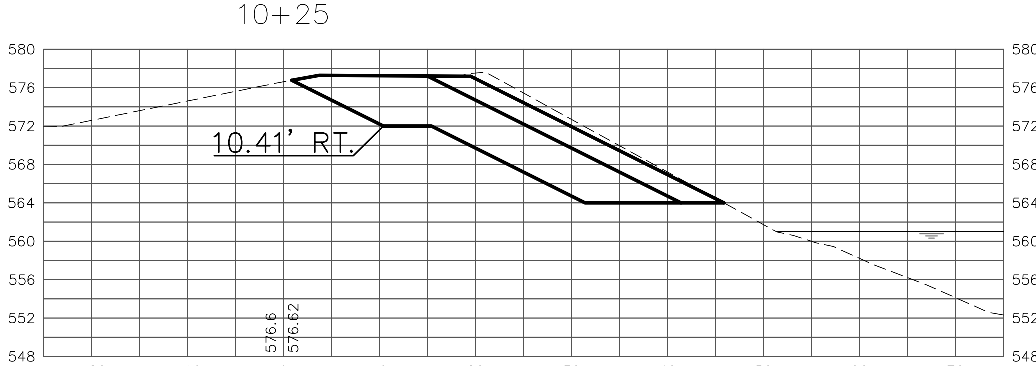

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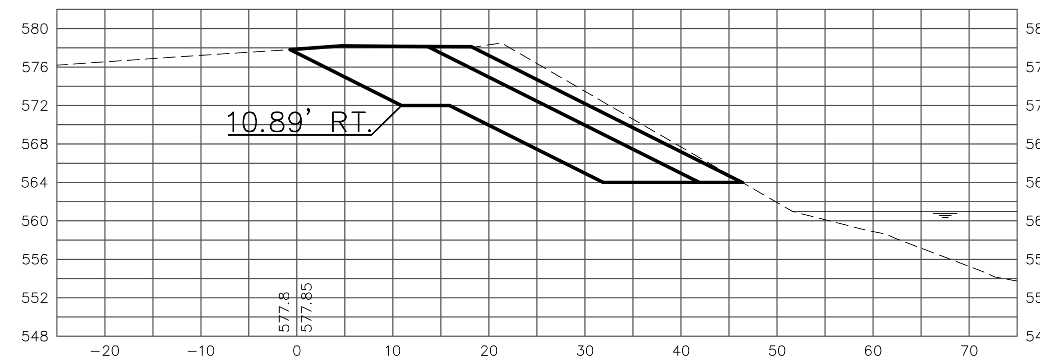

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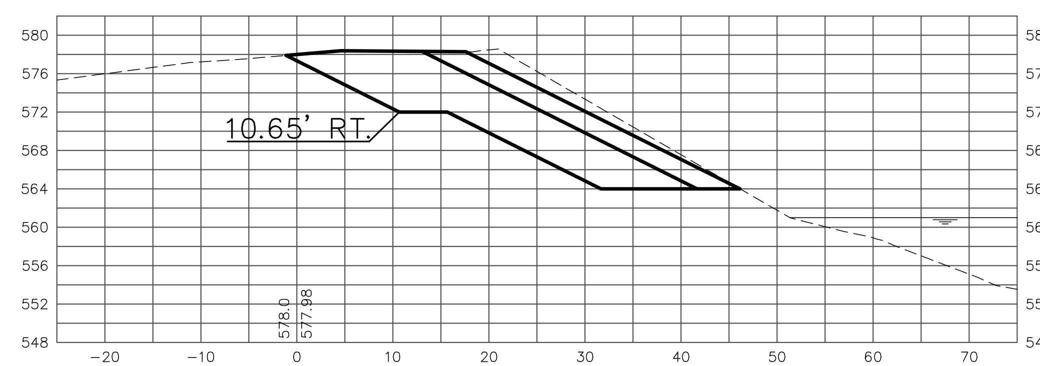

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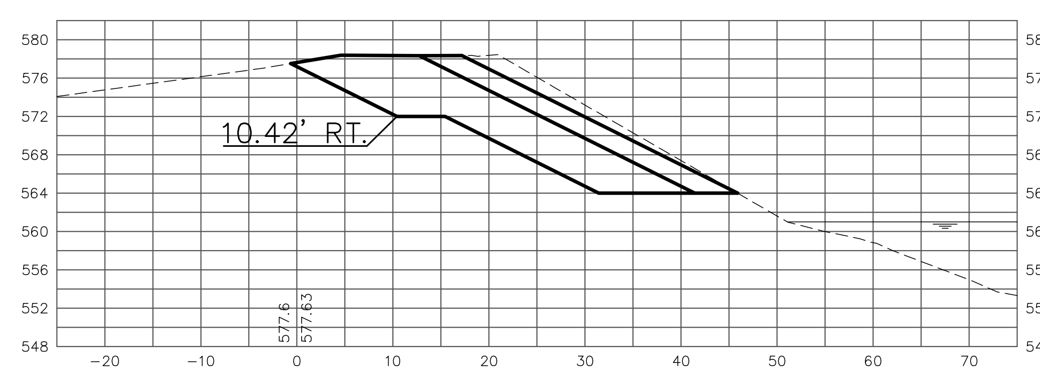

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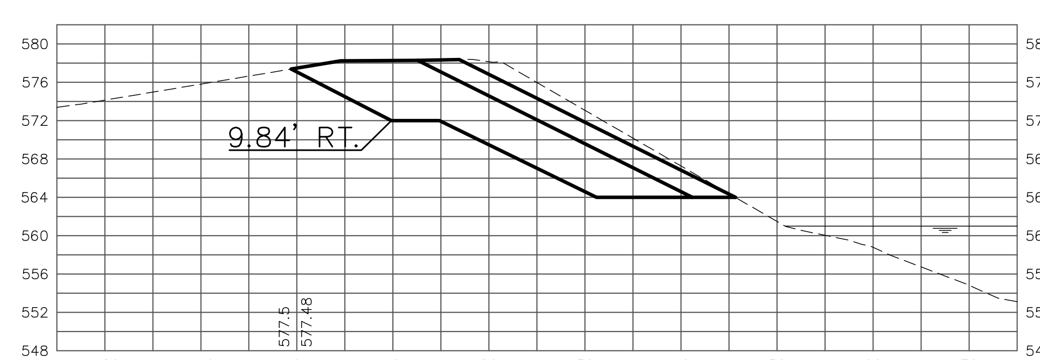

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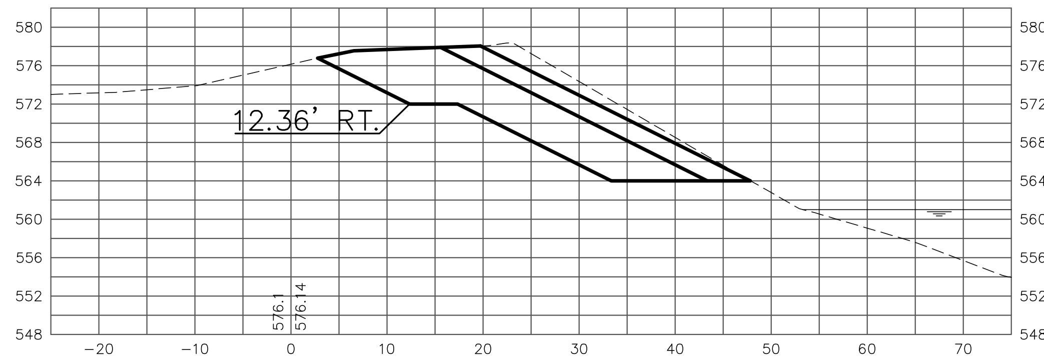

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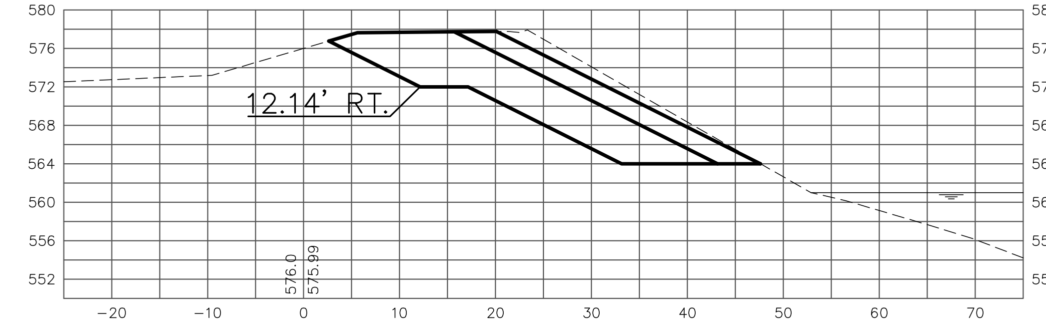

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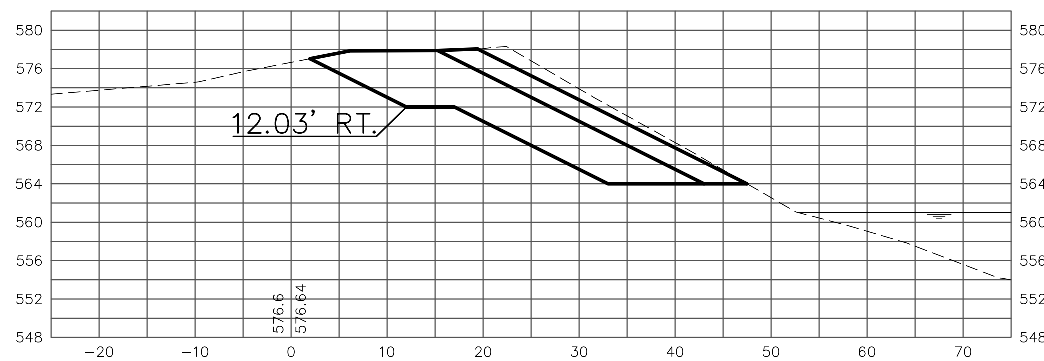

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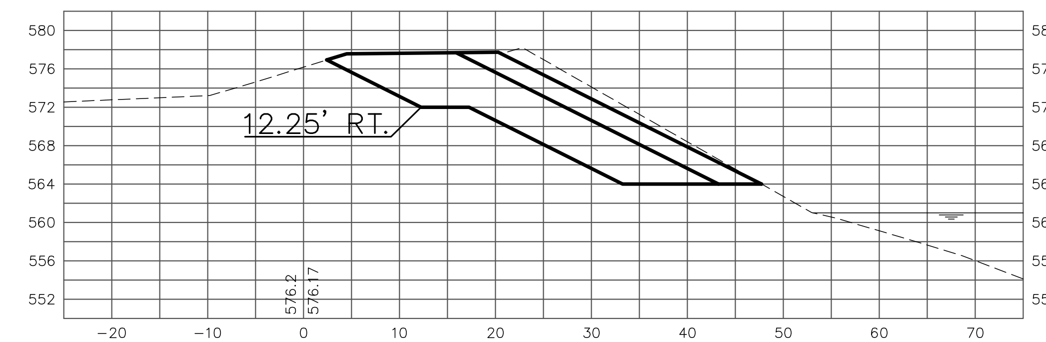

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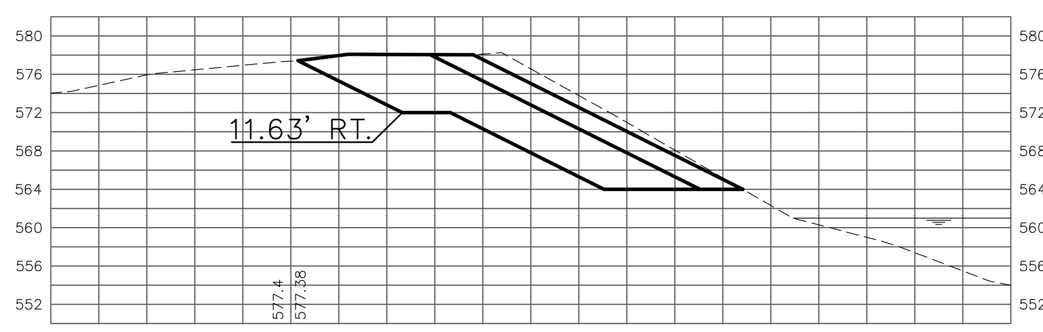

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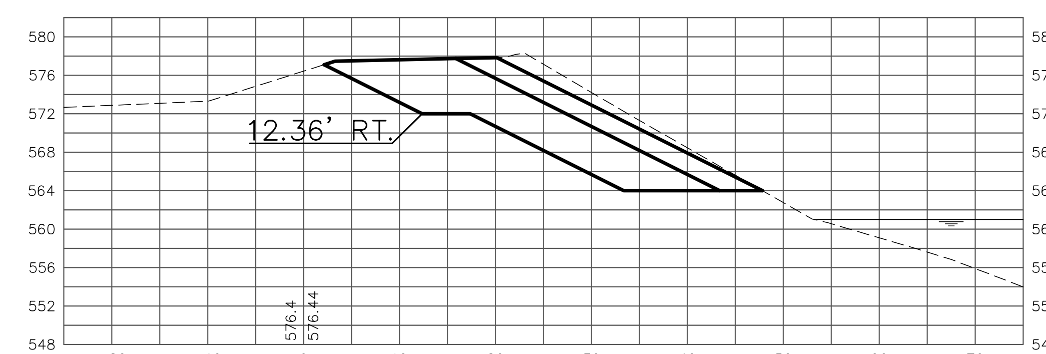

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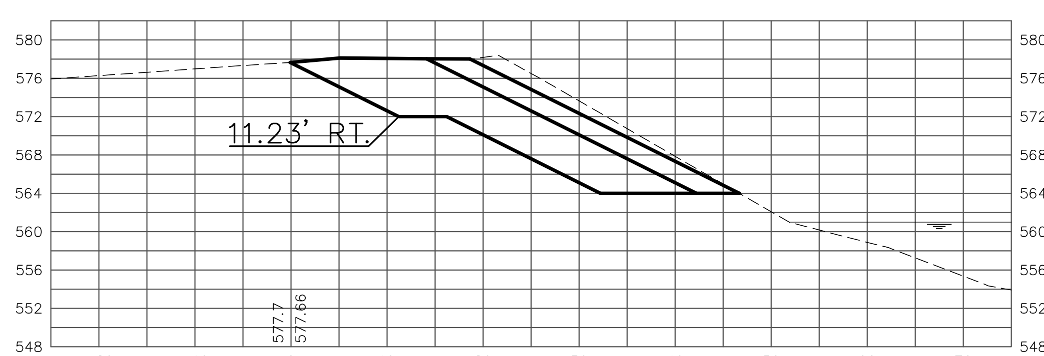

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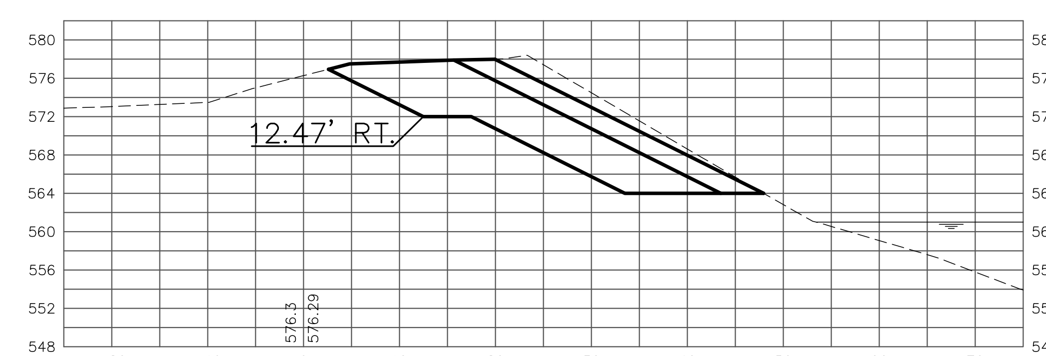

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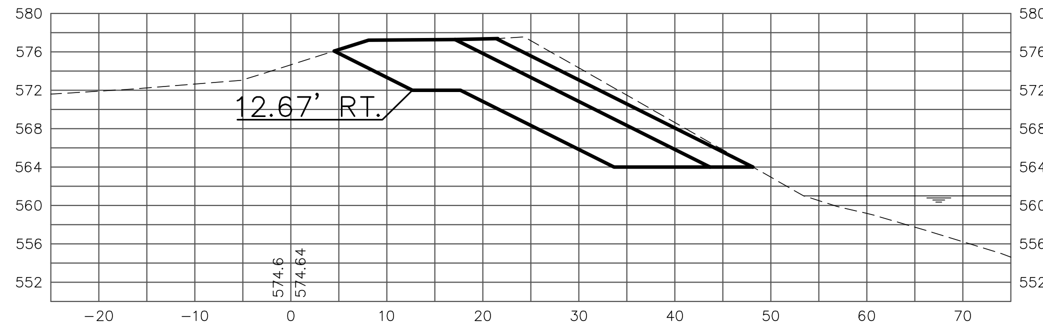

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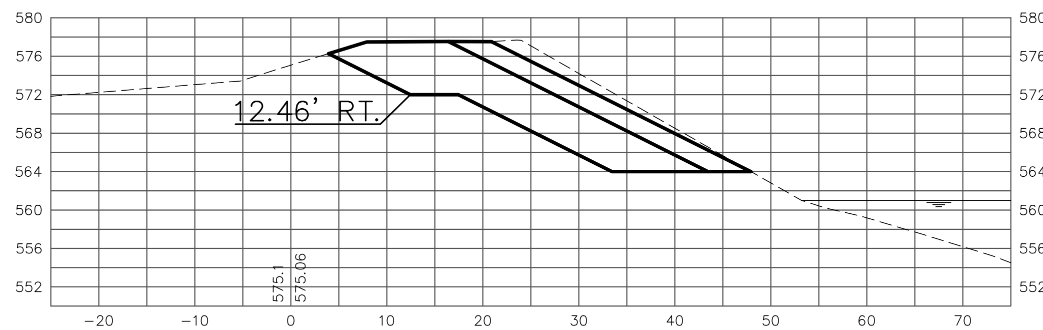

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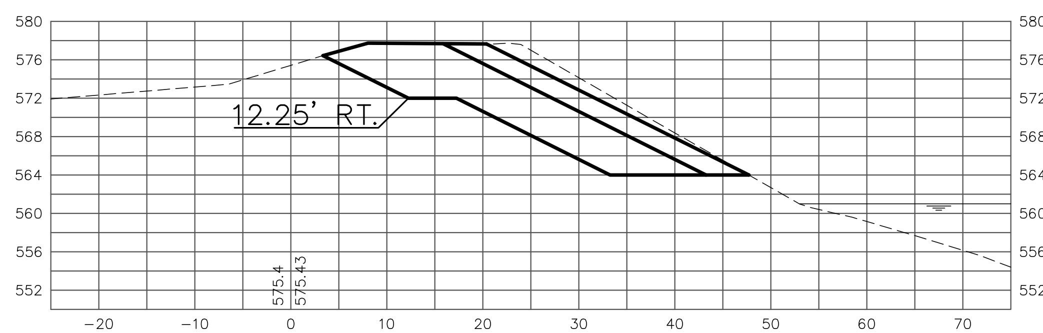

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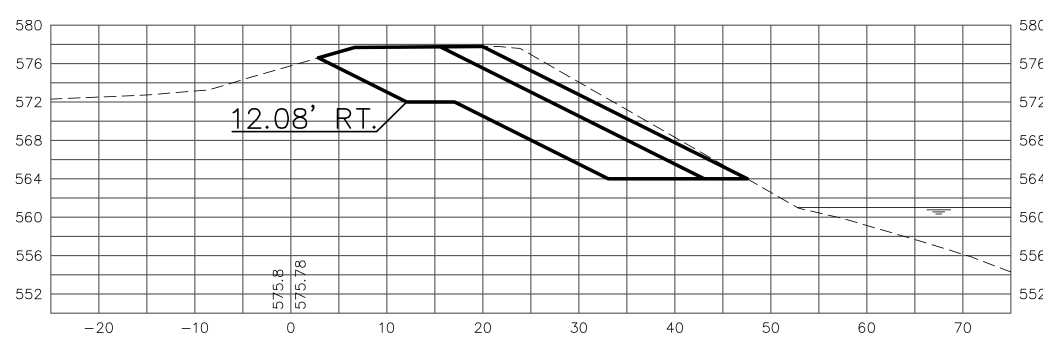

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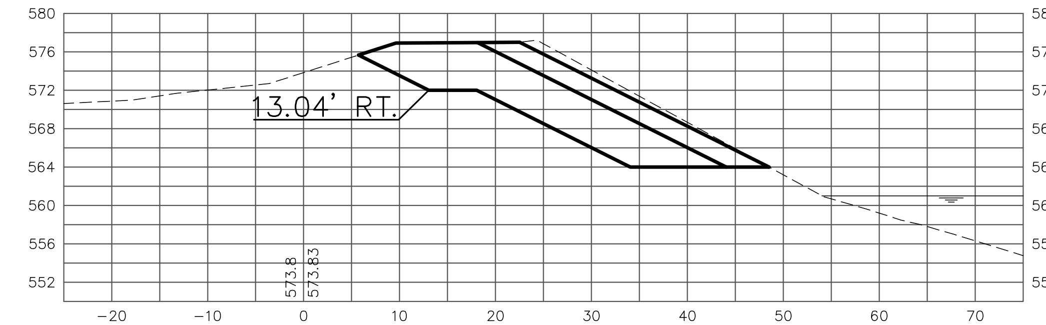

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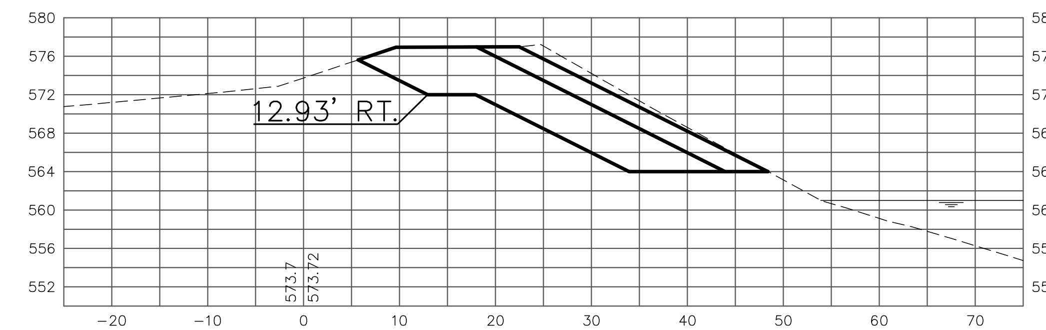

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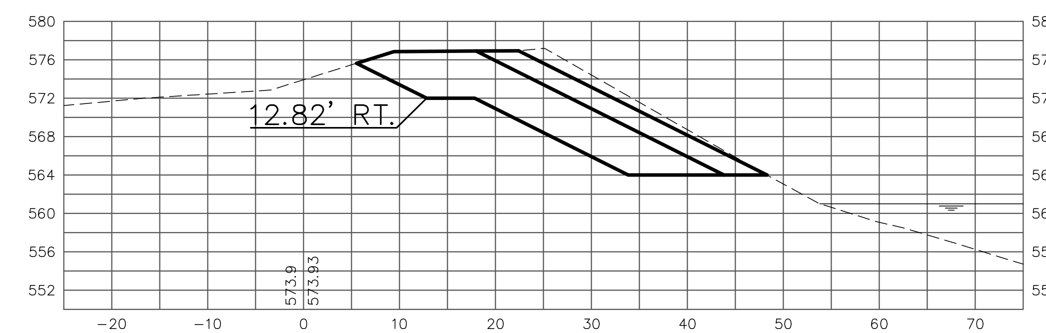

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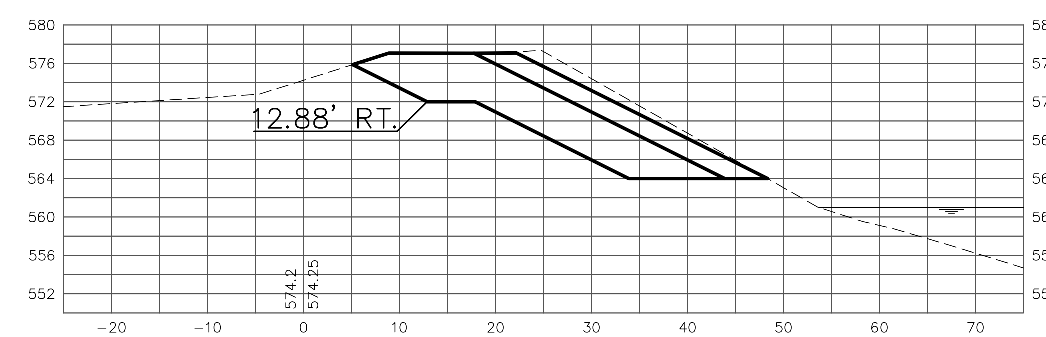

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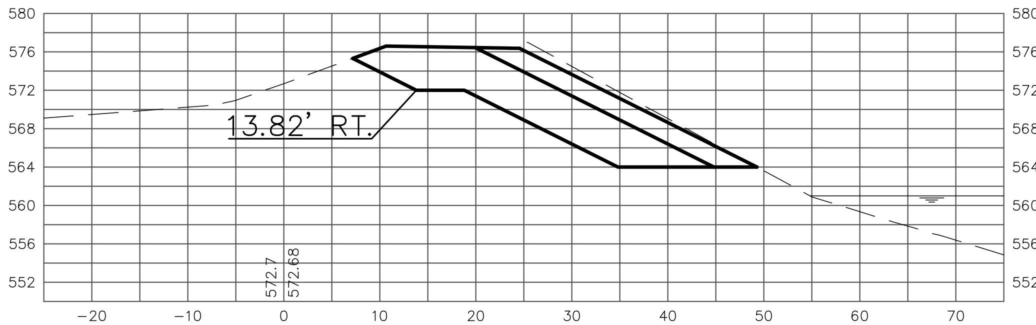

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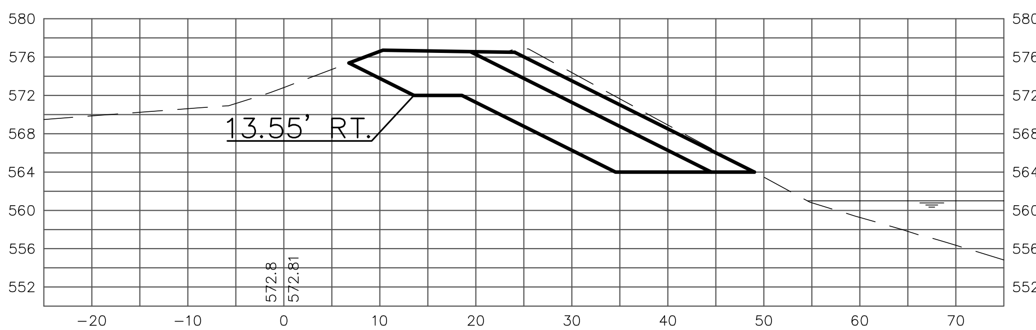

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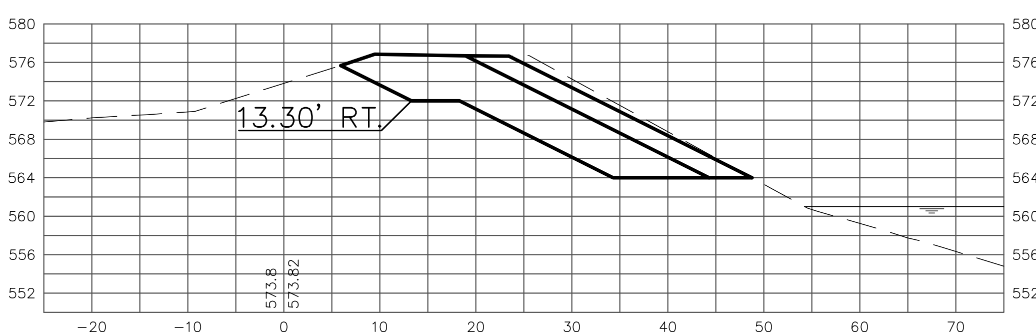

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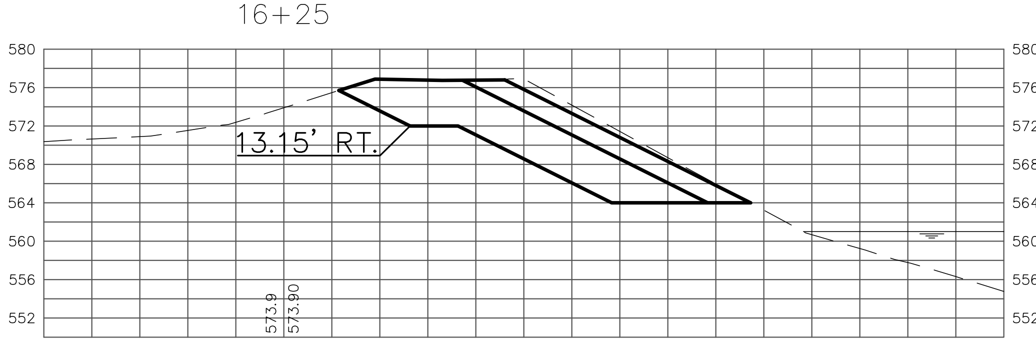

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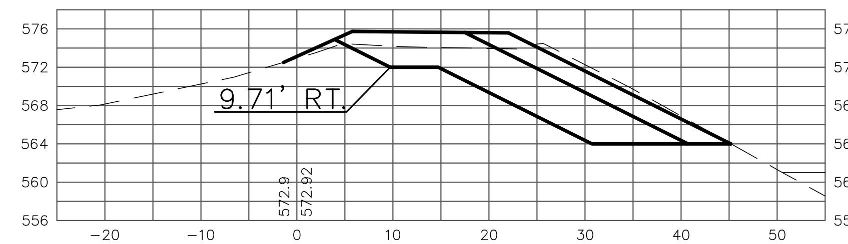

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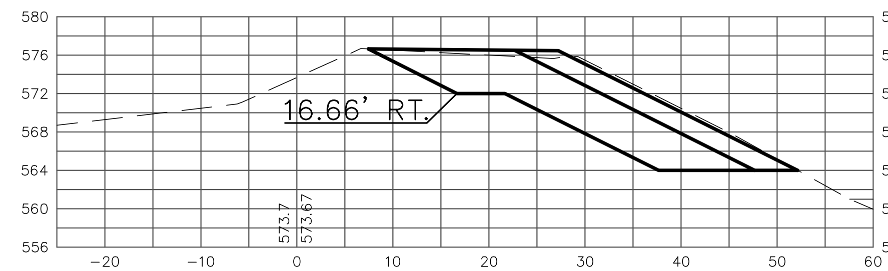

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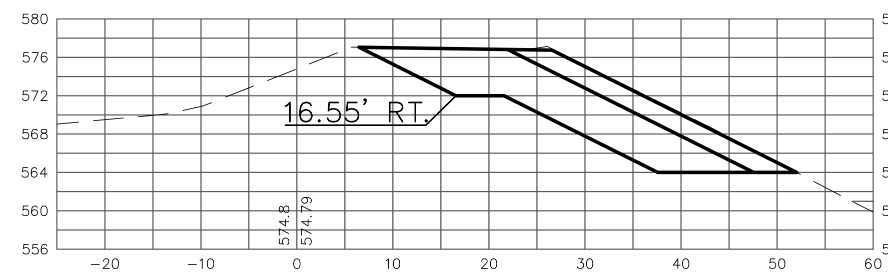

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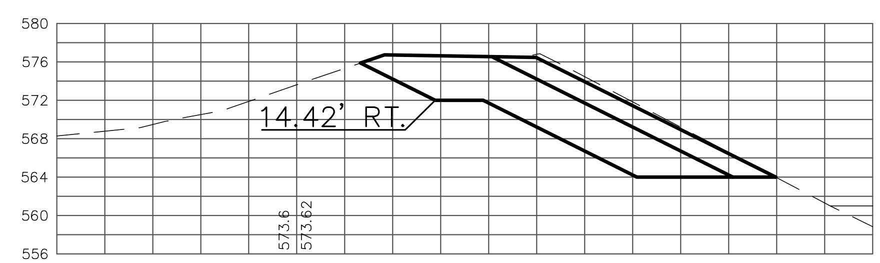

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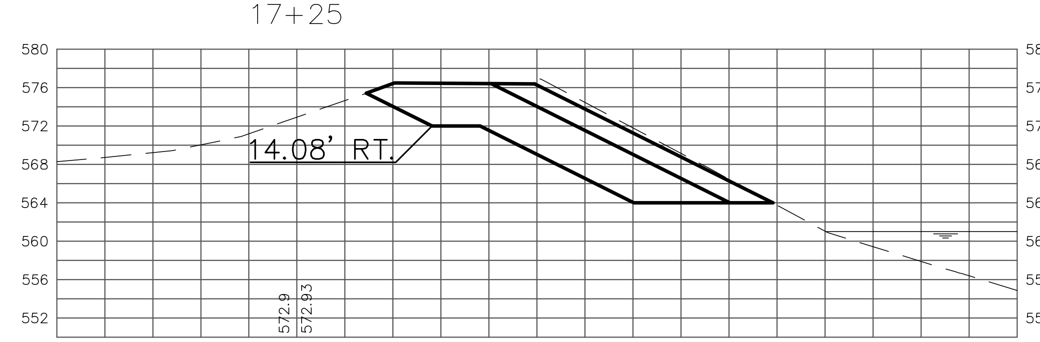
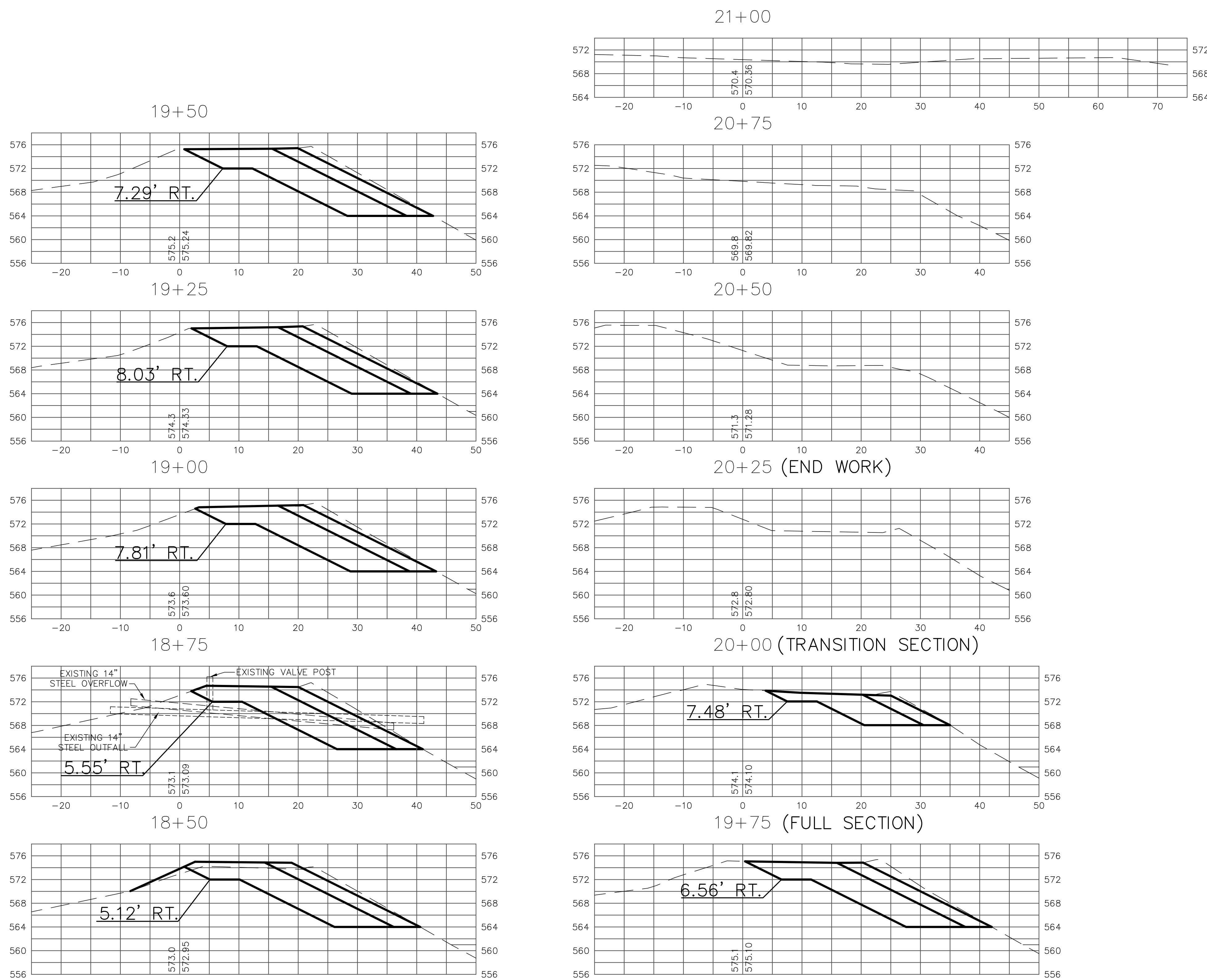
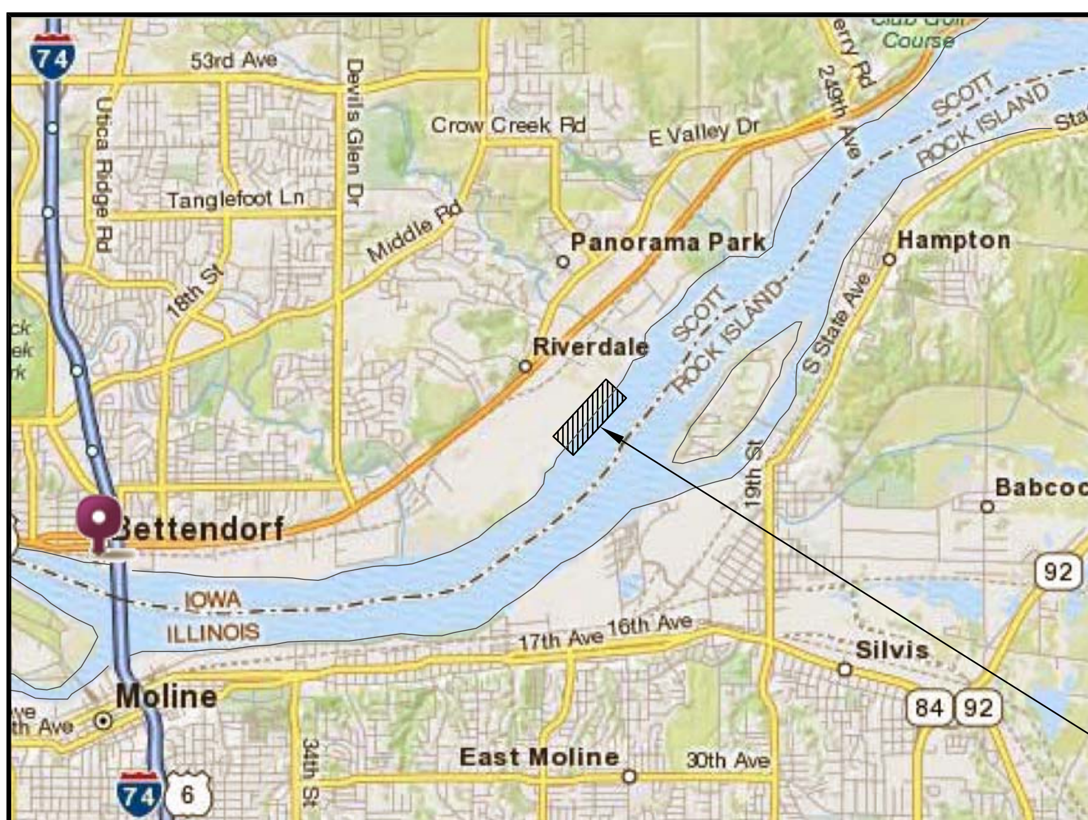




MEC RIVERSIDE SOUTH POND, HGM #112510A SHEET X.10

RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND
EMBANKMENT IMPROVEMENTS

CITY OF BETTENDORF, IOWA



PROJECT LOCATION

▨ – INDICATES PROJECT LOCATION

LOCATION MAP
BETTENDORF, IOWA
NO SCALE

INDEX

PAGE NO.	DESCRIPTION
A.01	TITLE SHEET, INDEX, CERTIFICATION, LOCATION MAP
D.01–D.02	EMBANKMENT IMPROVEMENTS PLAN, TYPICAL SECTION
X.01–X.10	CROSS SECTIONS

LICENSED PROFESSIONAL ENGINEER
TERRENCE L. SMITH
1384
IOWA

PRELIMINARY

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

TERRENCE L. SMITH

My license renewal date is December 31, 2012.

Pages or sheets covered by this seal:

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ASSOCIATES INC.
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PHONE: (712) 323-0530

LAL drawn
LAL designed
TLS approved
DEC.'10 date
revision
date

project RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND EMBANKMENT IMPROVEMENTS

client MIDAMERICAN ENERGY COMPANY
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501

sheet **TITLE SHEET**

project no. 112510A

sheet **A.01**

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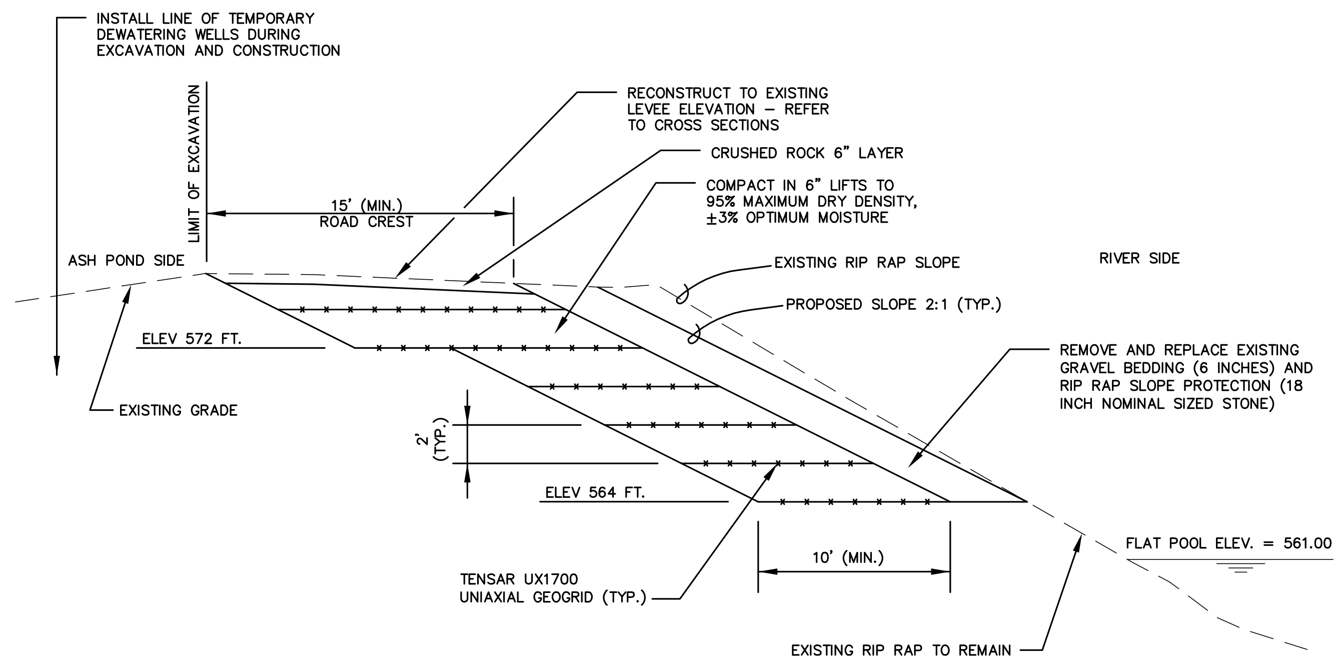

TYPICAL SECTION

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LAL designed
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SOUTH ASH CONTAINMENT POND EMBANKMENT IMPROVEMENTS

client MIDAMERICAN ENERGY COMPANY
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501

sheet **TYPICAL SECTION**

project no.
112510A

sheet
B.01

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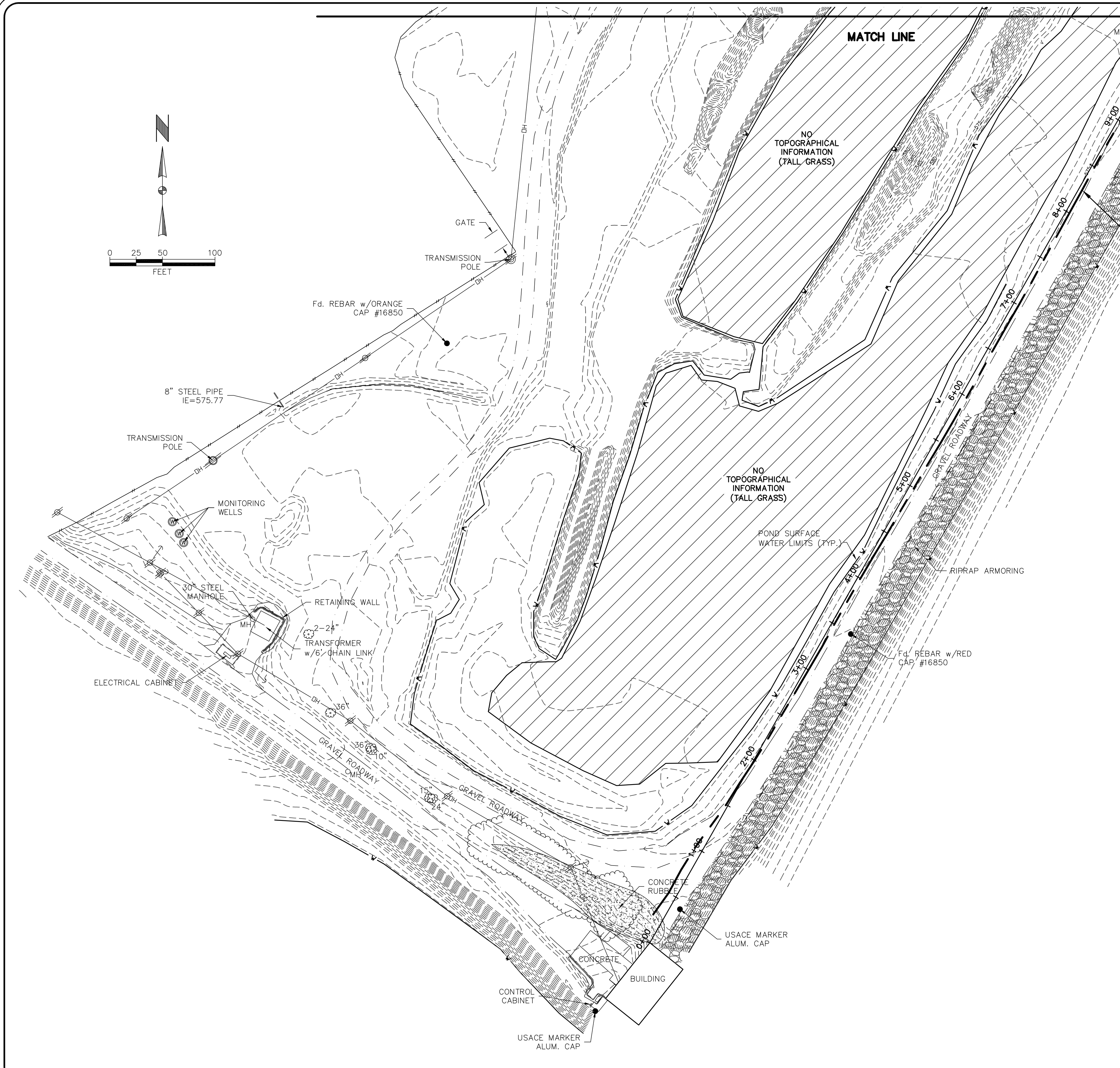

Horizontal Alignment Station and Curve Report.
Alignment: LEVEE
Desc: LEVEE

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PI	17+67.67		574816.62	2475250.03
		Length: 17.77	Course: N 29-36-20 E	
		Delta: 0-02-42		
		Tangent Data		
	0+00		573280.41	2474375.55
	17+67.67		574816.62	2475250.03
		Length: 1767.67	Course: N 29-39-02 E	
PI	17+85.44		574832.07	2475258.80
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		Delta: 47-40-44		
		Circular Curve Data		
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RP			574836.48	2475215.07
PT	18+01.13		574848.96	2475253.29
		Delta: 47-40-44	Type: LEFT	
		Radius: 40.20	DOC: 142-30-39	
		Length: 33.46	Tangent: 17.77	
		Mid-Ord: 3.43	External: 3.75	
		Chord: 32.50	Course: N 05-45-58 E	
		Es: 3.75		
PI	18+38.11		574884.11	2475241.82
		Length: 194.05	Course: N 44-32-39 W	
		Delta: 26-28-14		
		Circular Curve Data		
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RP			574800.18	2475103.82
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		Length: 72.64	Tangent: 36.98	
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		Chord: 71.99	Course: N 31-18-32 W	
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	21+00		575064.04	2475050.40
		Length: 54.37	Course: N 53-01-54 W	

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revision
date

project RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND EMBANKMENT IMPROVEMENTS
client MIDAMERICAN ENERGY COMPANY
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501
sheet **EMBANKMENT IMPROVEMENTS PLAN**

project no. 112510A
sheet **D.01**

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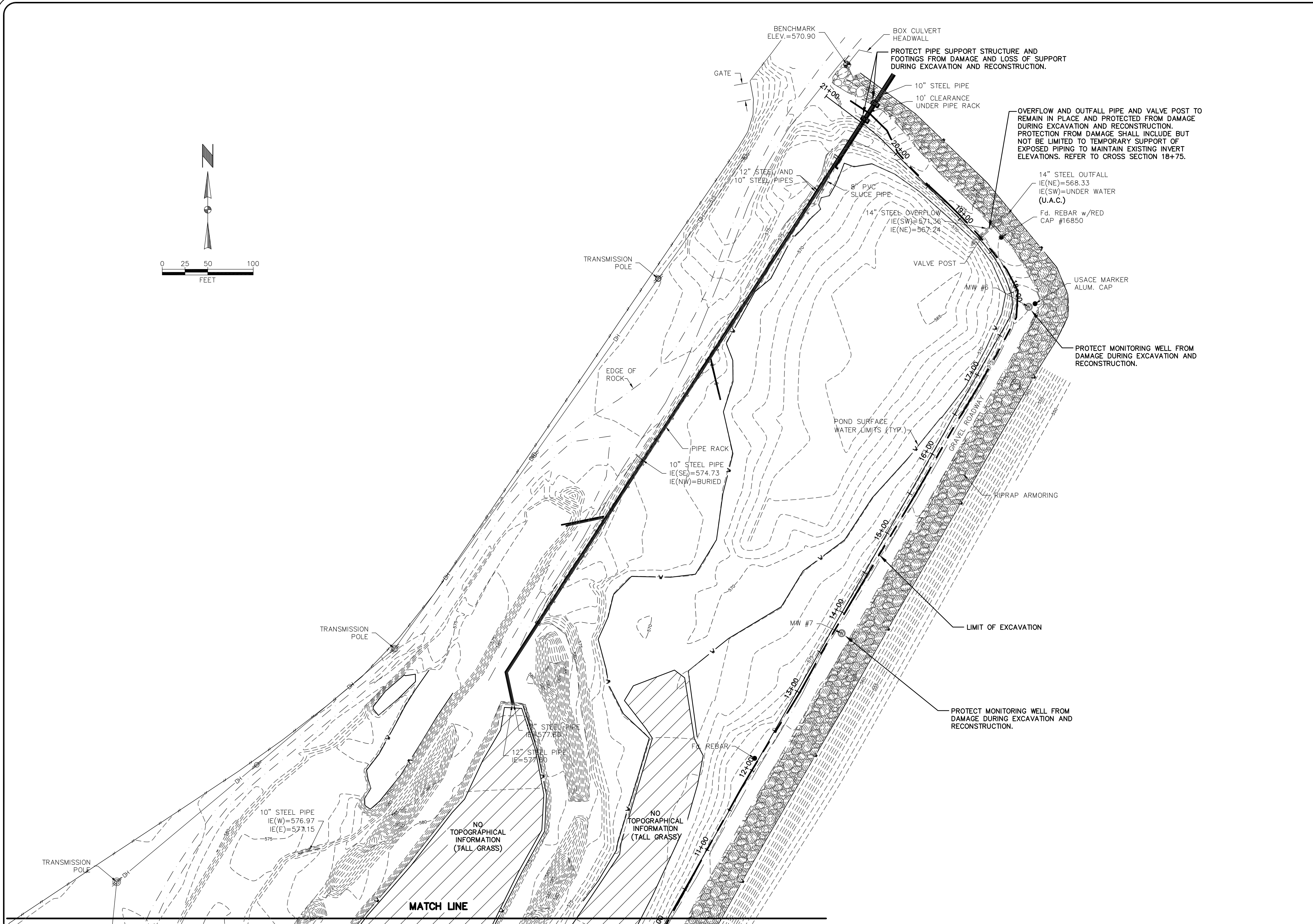

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640 FIFTH AVENUE COUNCIL BLUFFS, IOWA
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project RIVERSIDE GENERATING STATION
SOUTH ASH CONTAINMENT POND EMBANKMENT IMPROVEMENTS
client MIDAMERICAN ENERGY COMPANY
7215 NOVAJO ROAD, COUNCIL BLUFFS, IOWA 51501
sheet **EMBANKMENT IMPROVEMENTS PLAN**

project no.
112510A
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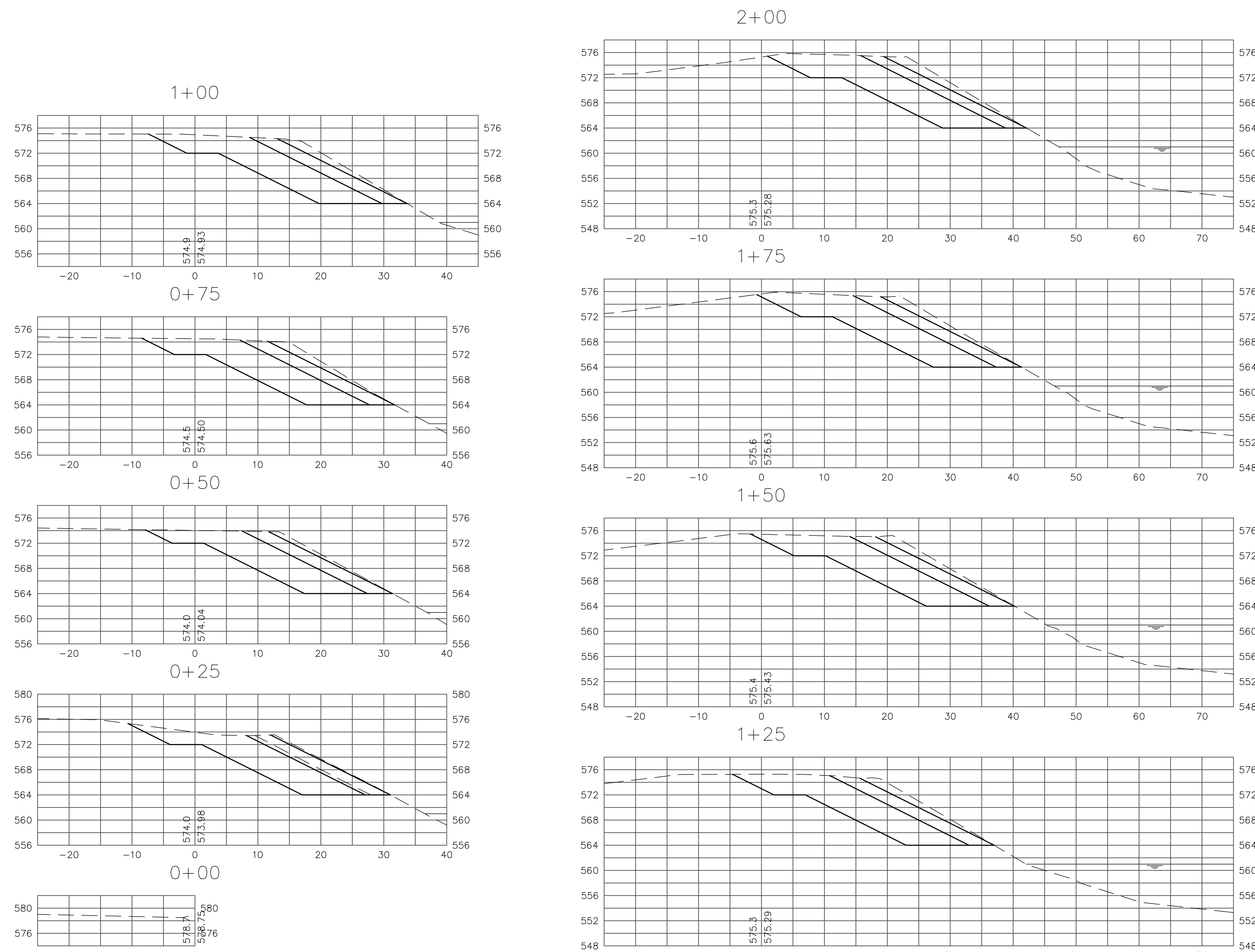
D.02



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MEC RIVERSIDE SOUTH POND, HGM #112510A SHEET X.01

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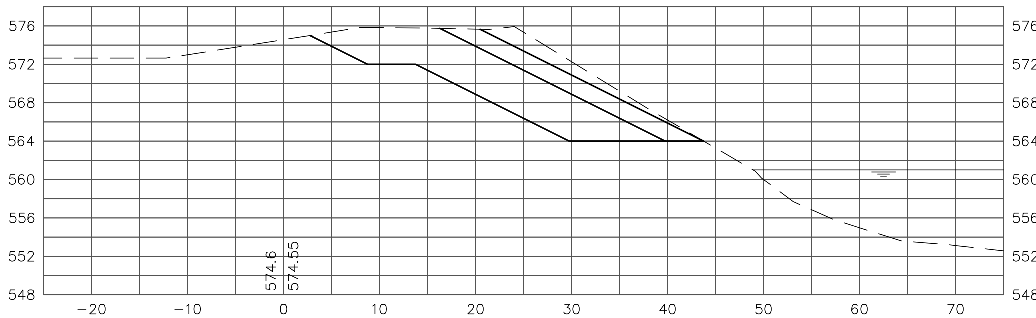

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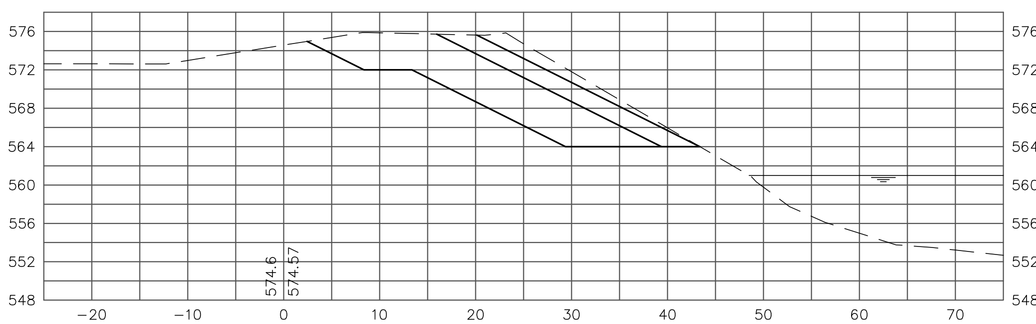

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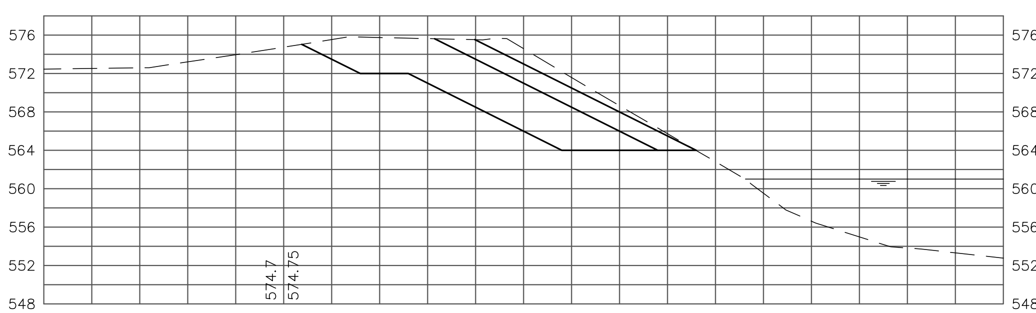

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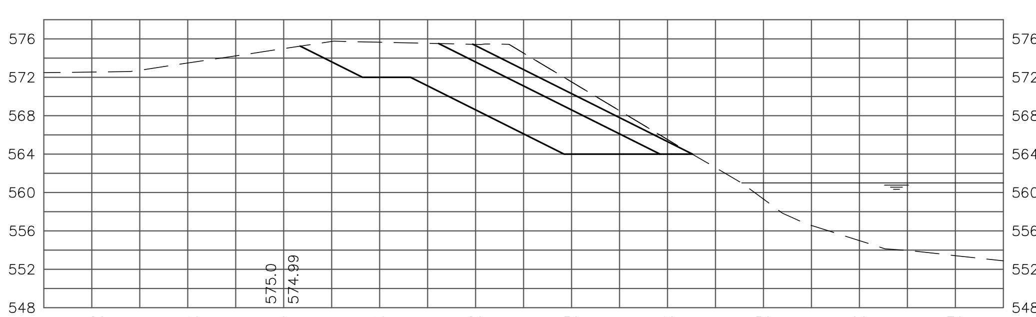

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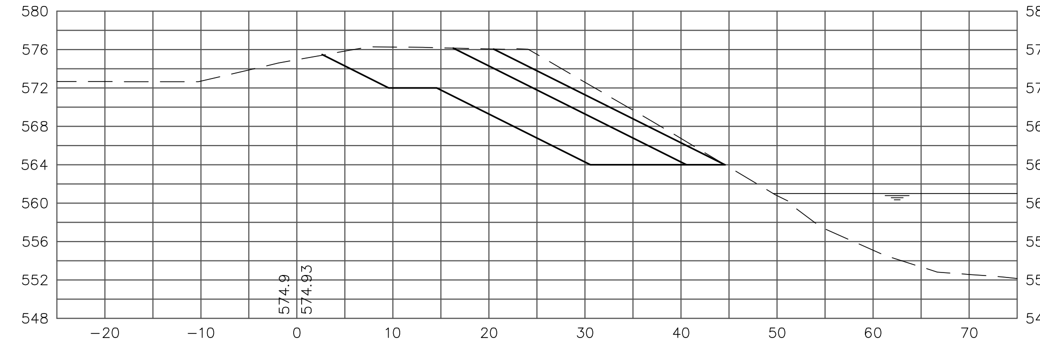

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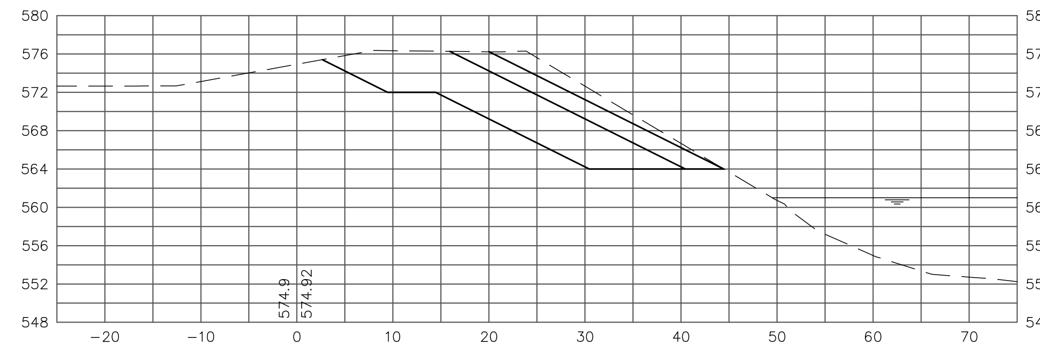

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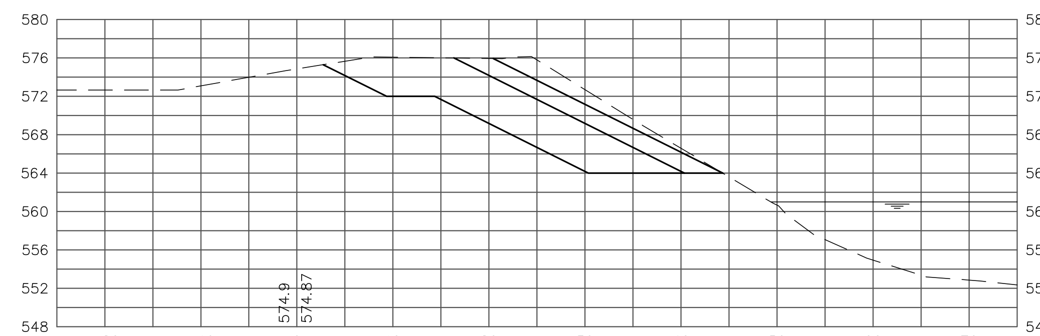

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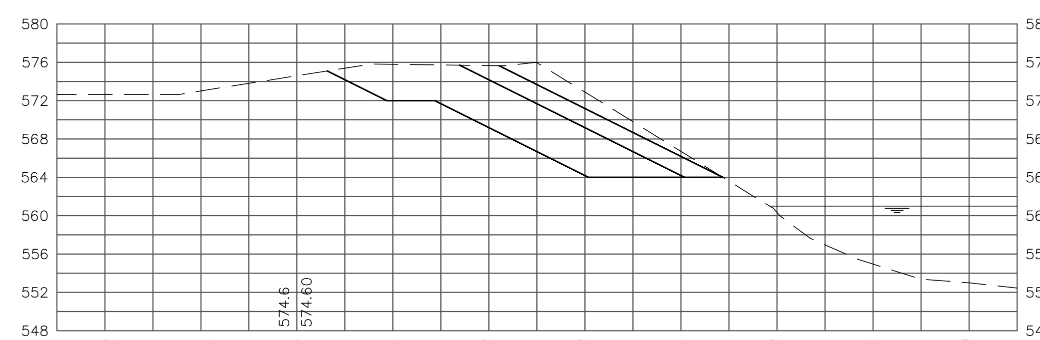

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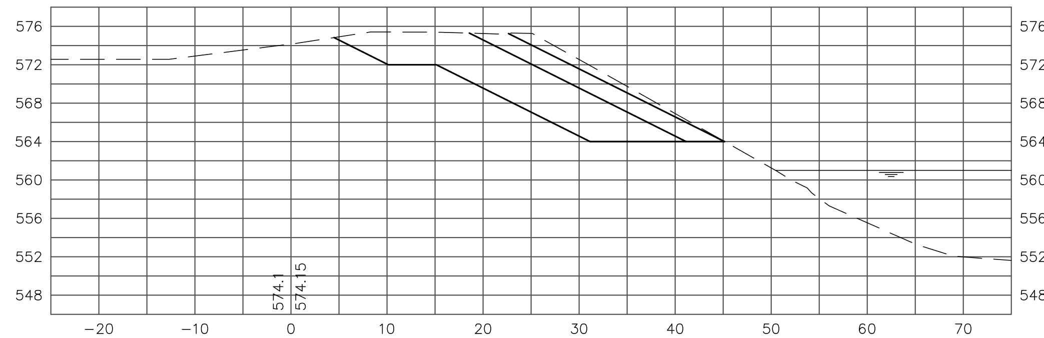

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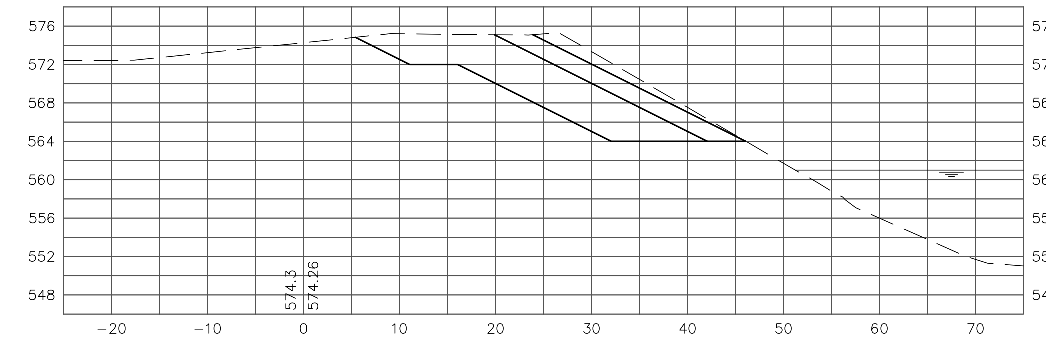

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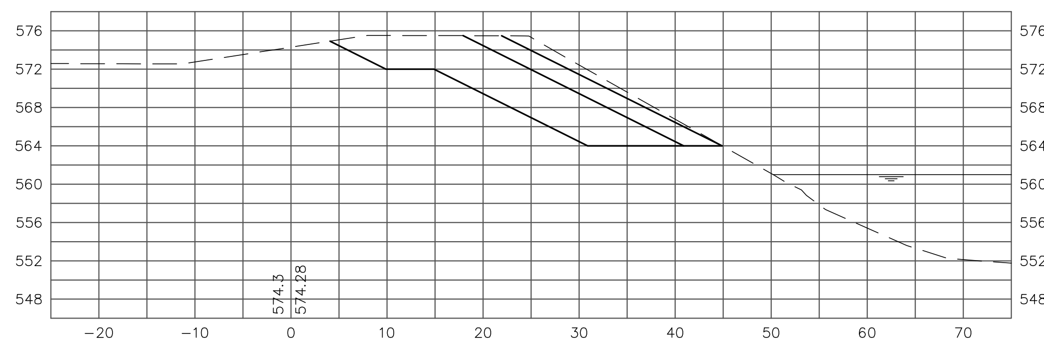

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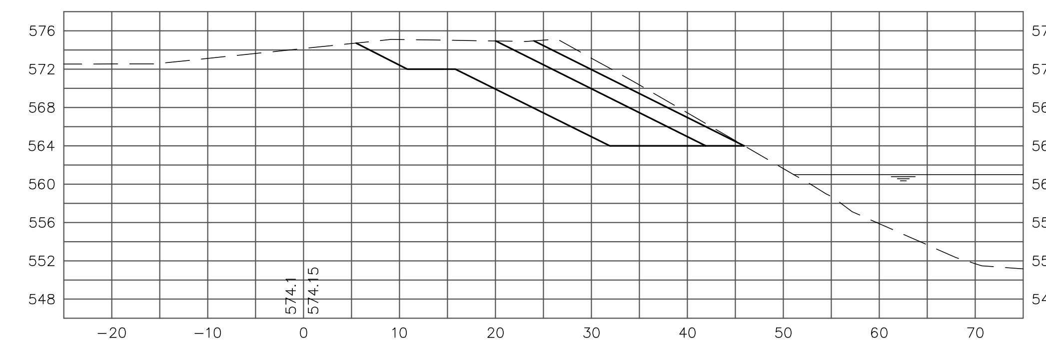

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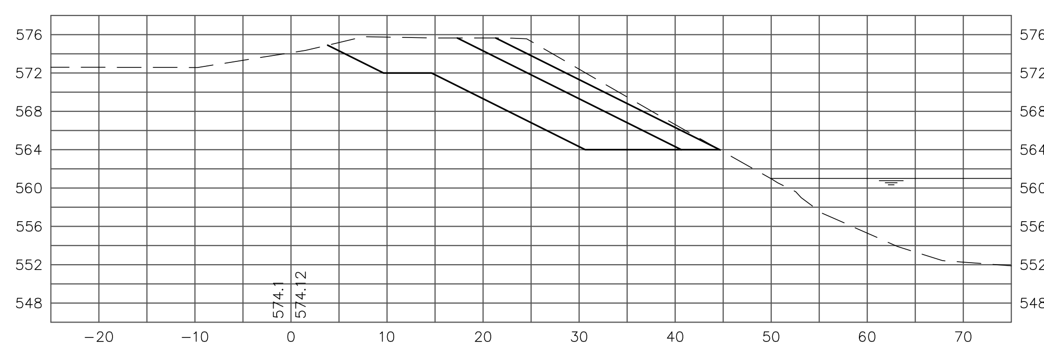

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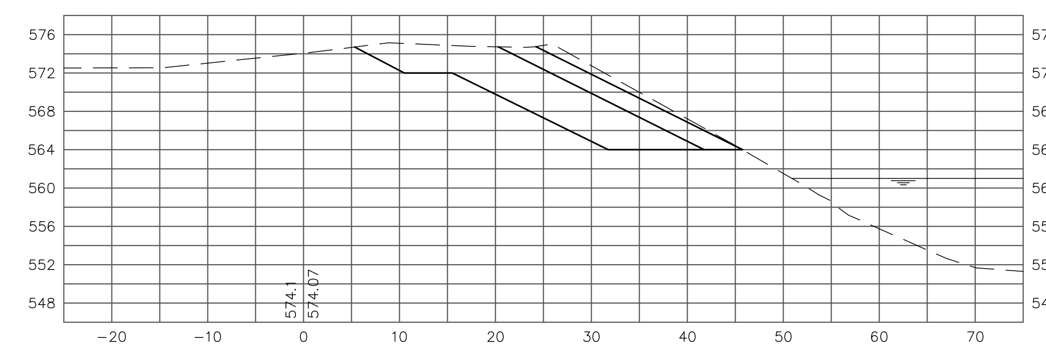

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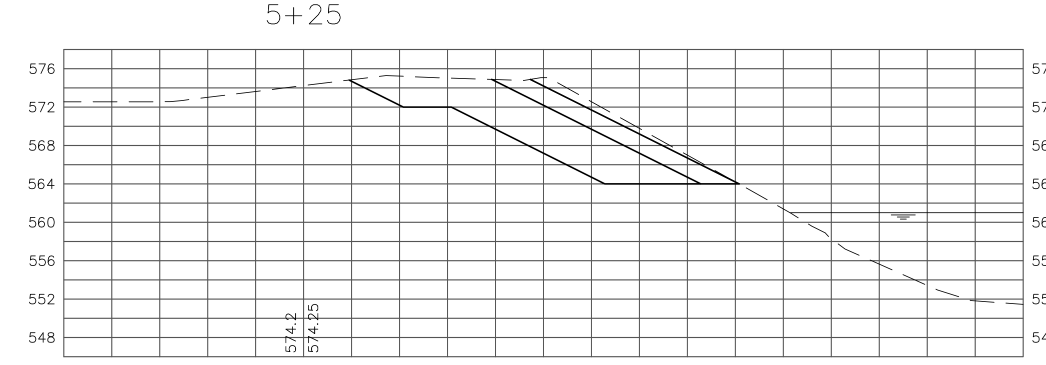

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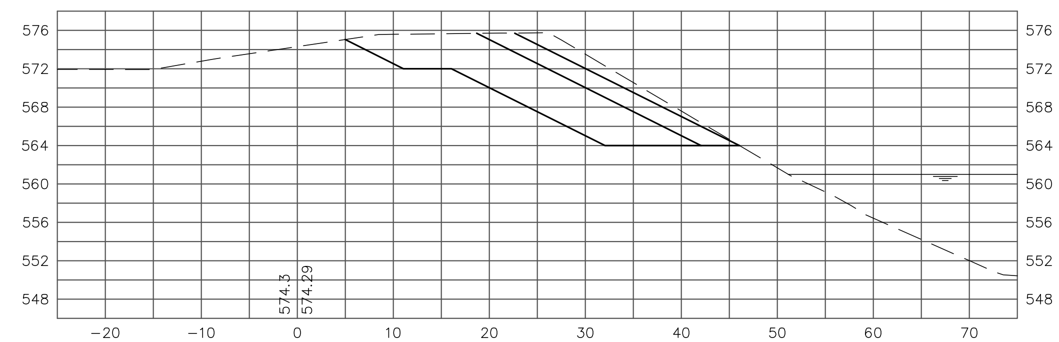

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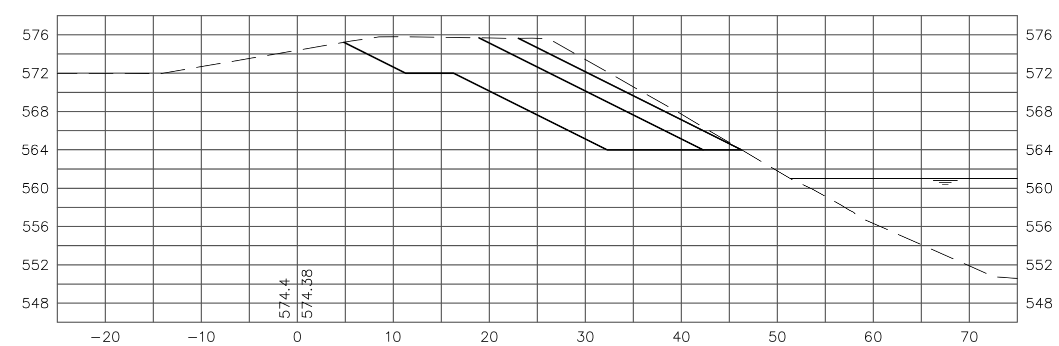

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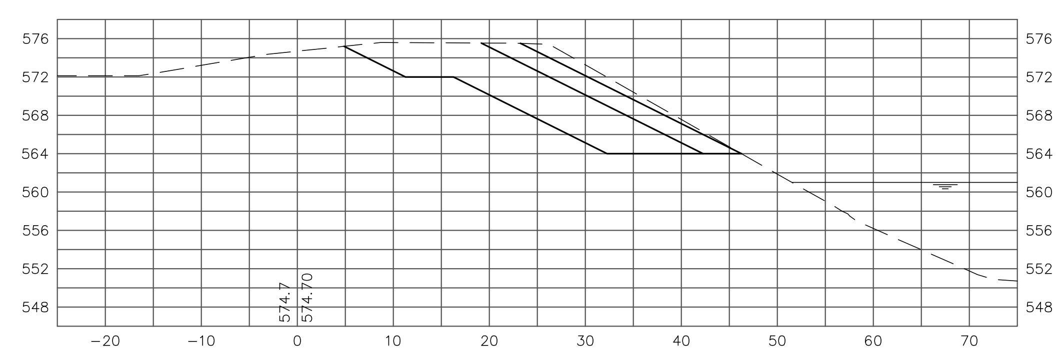

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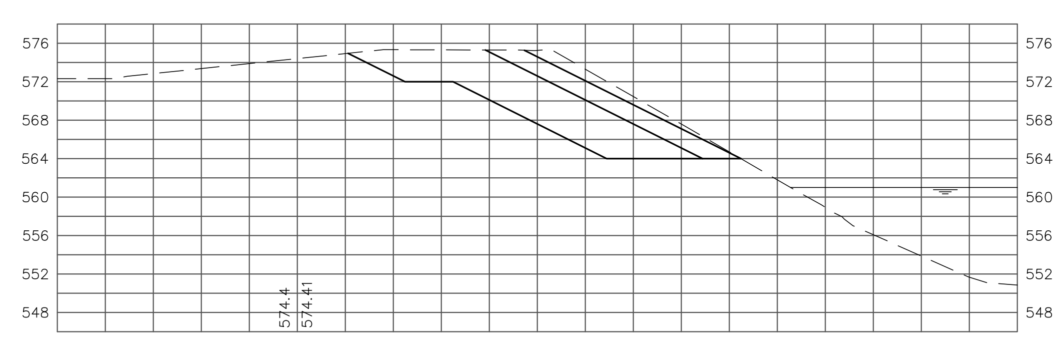

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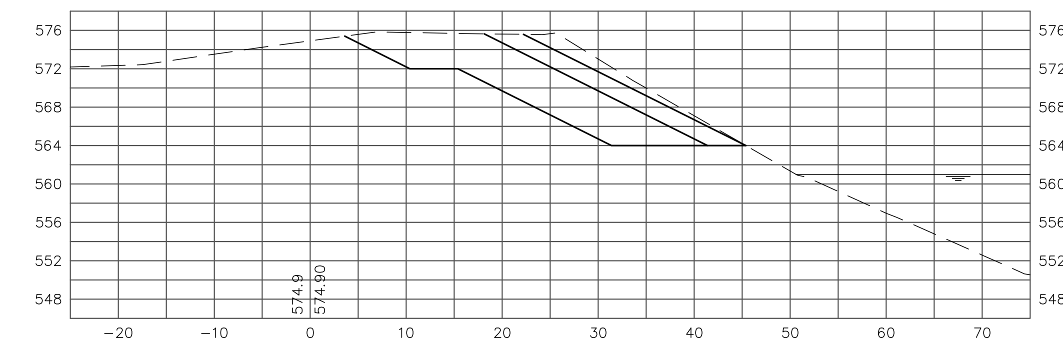

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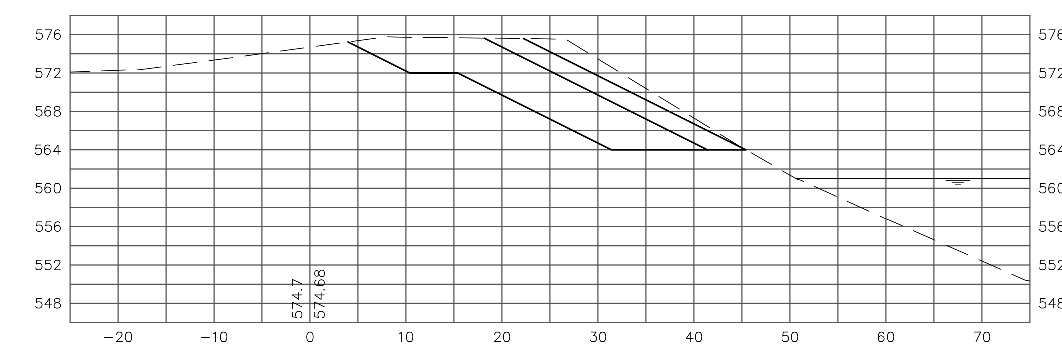

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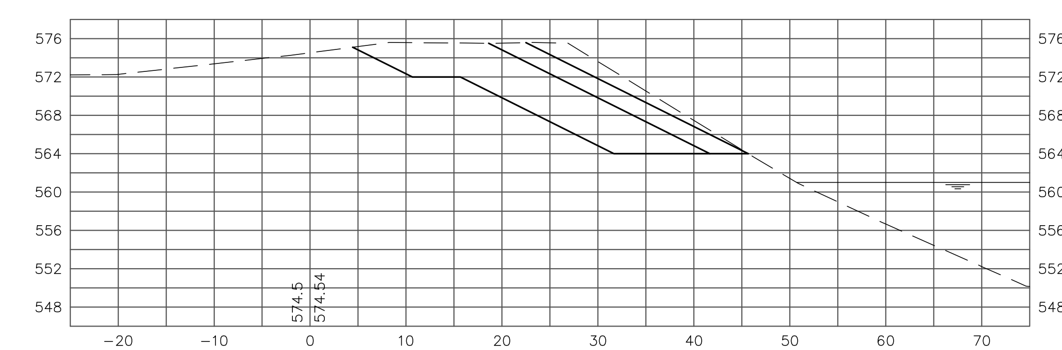

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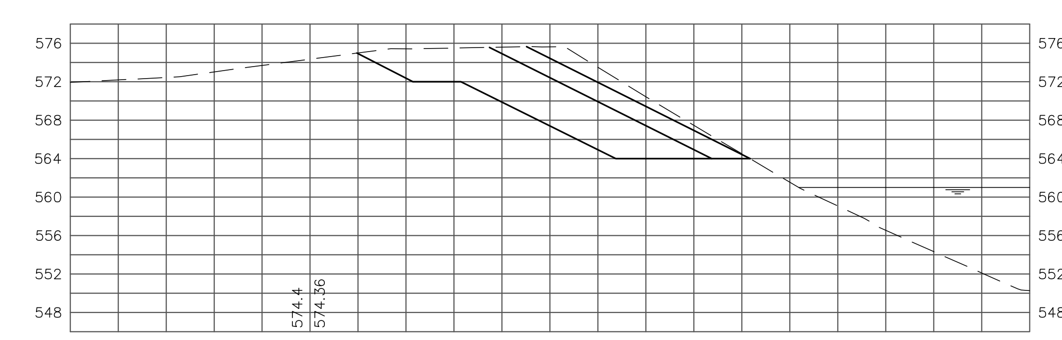

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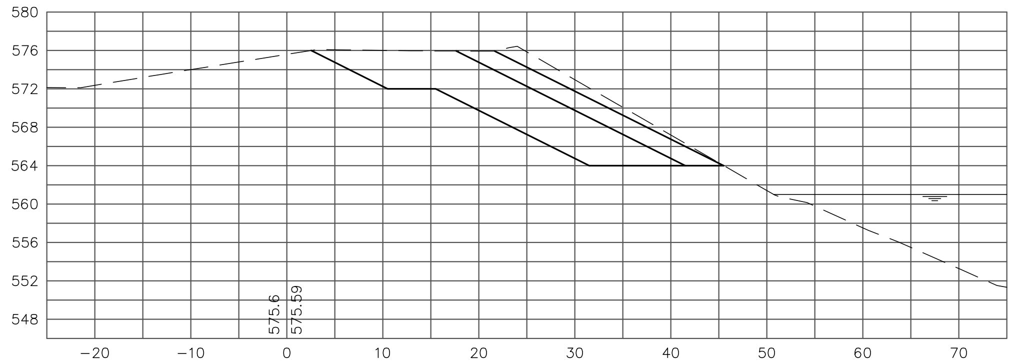

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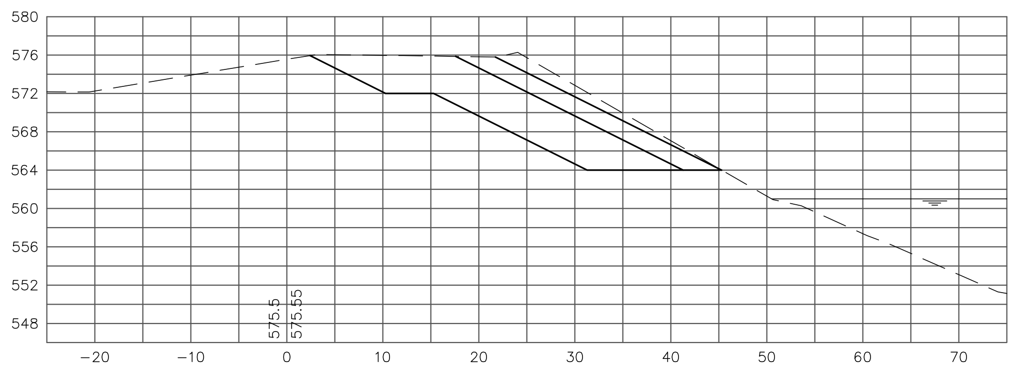

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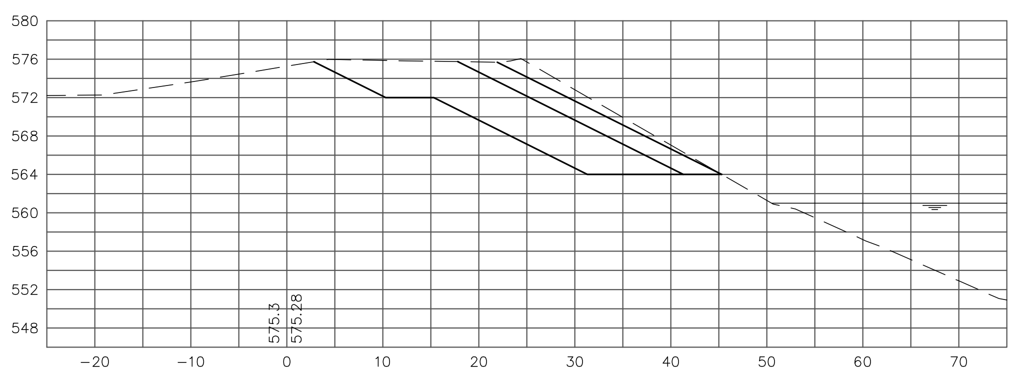

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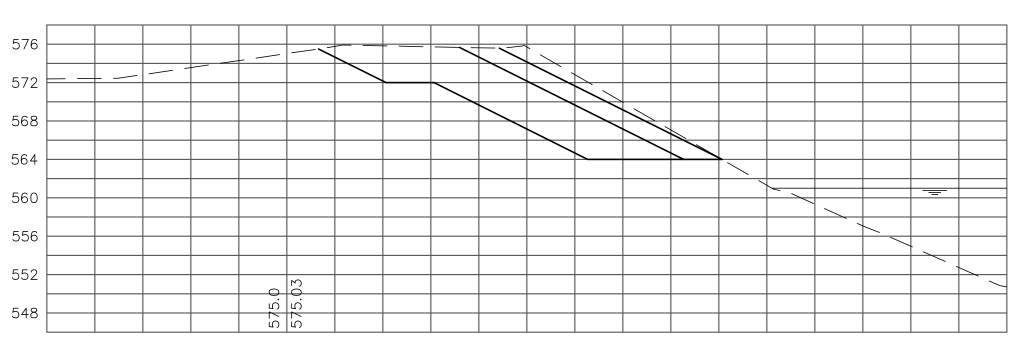

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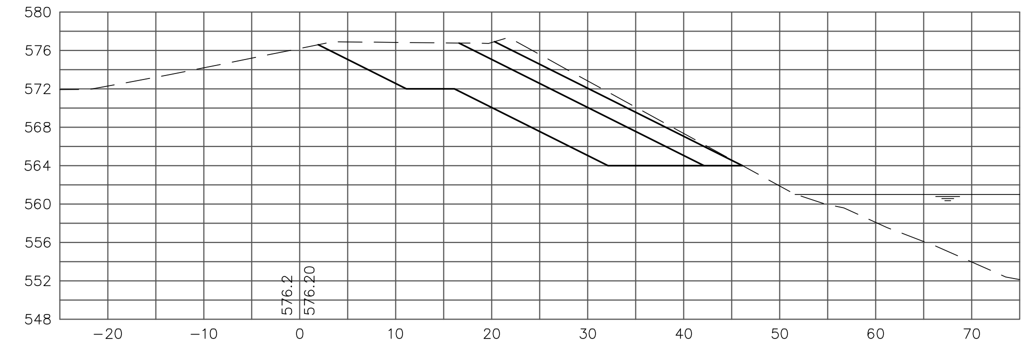

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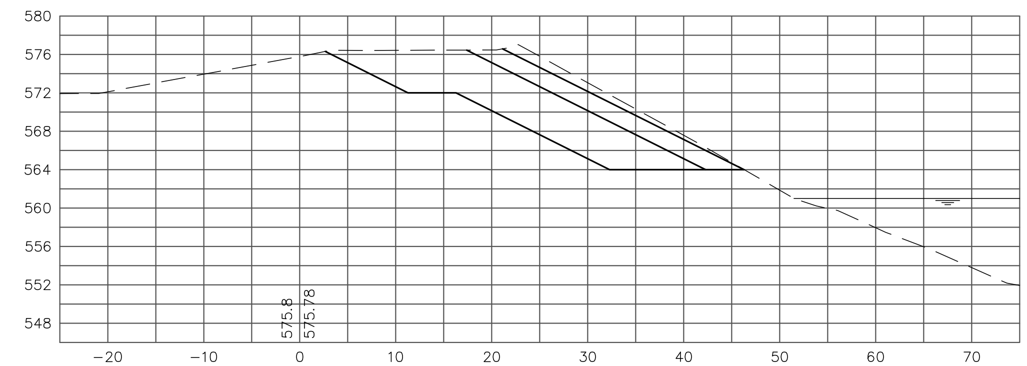

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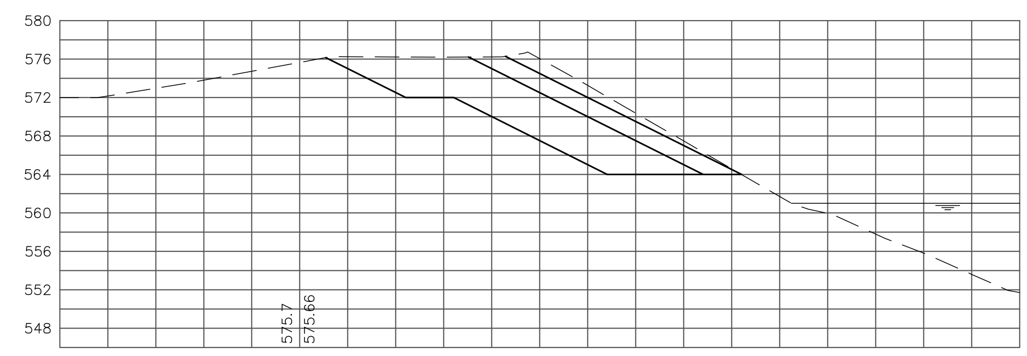

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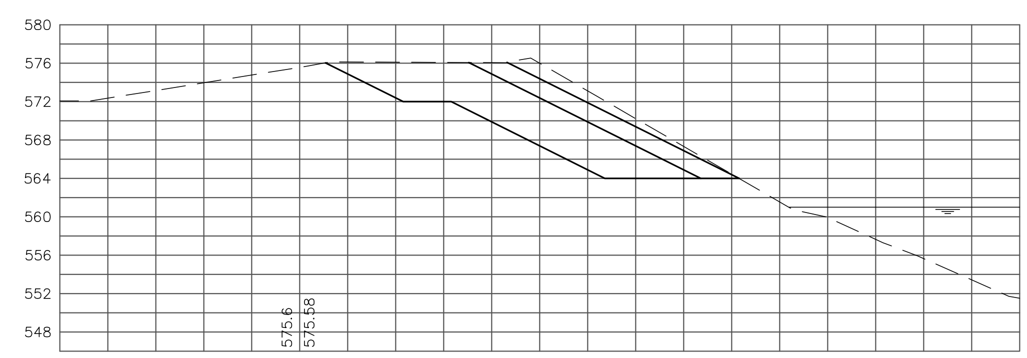

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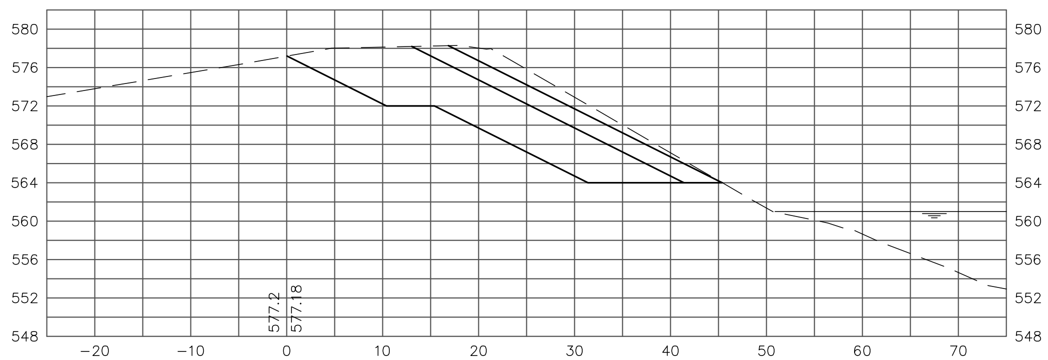

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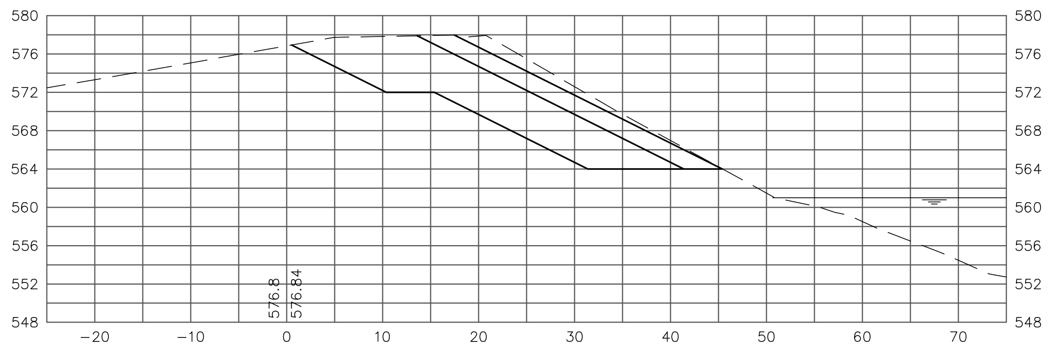

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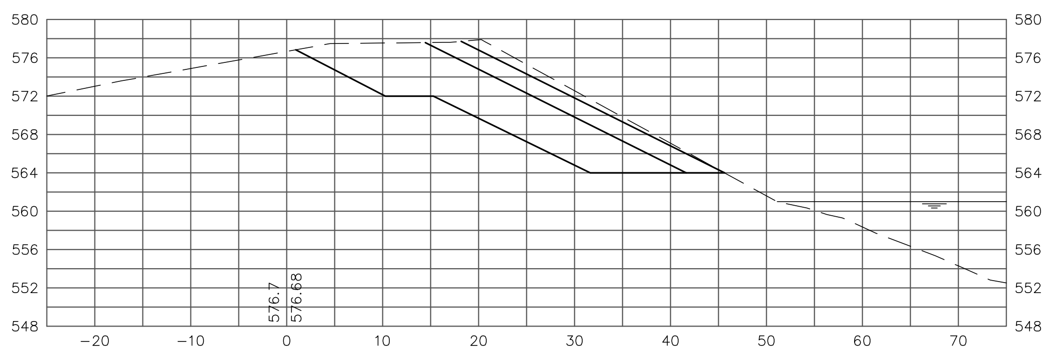

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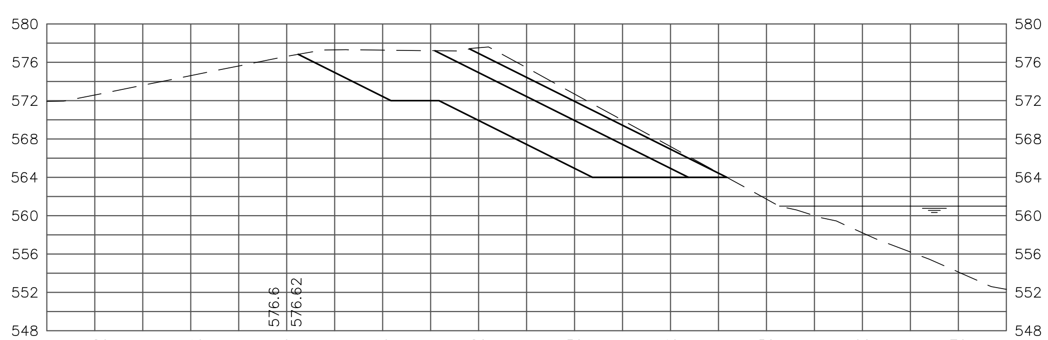

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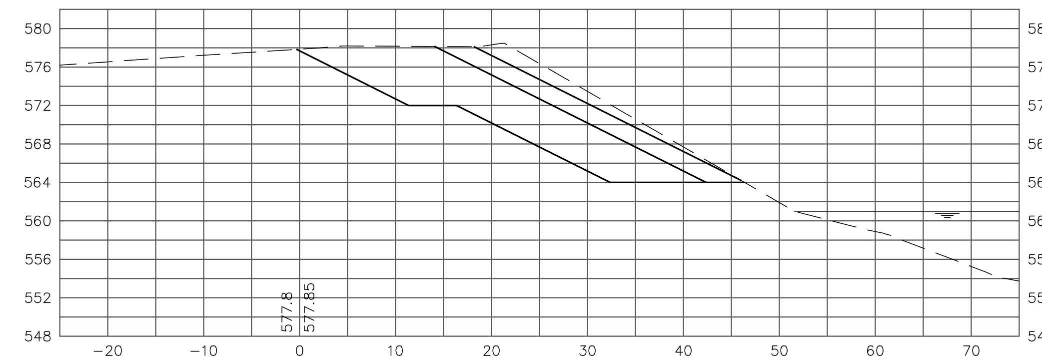

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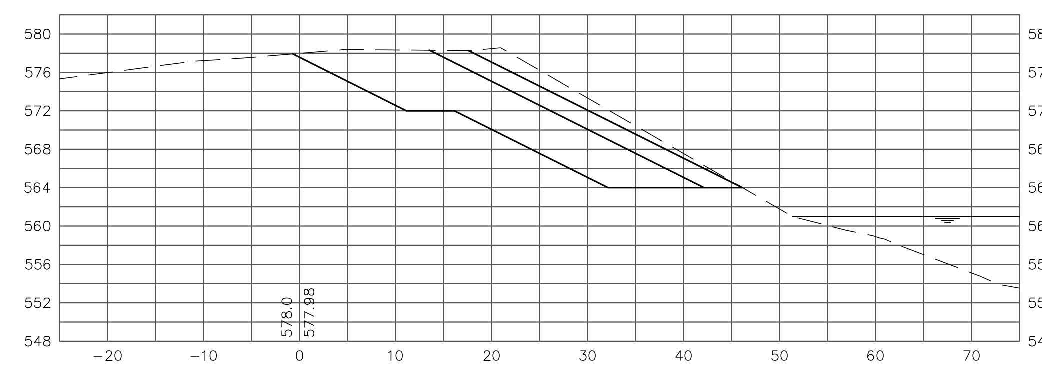

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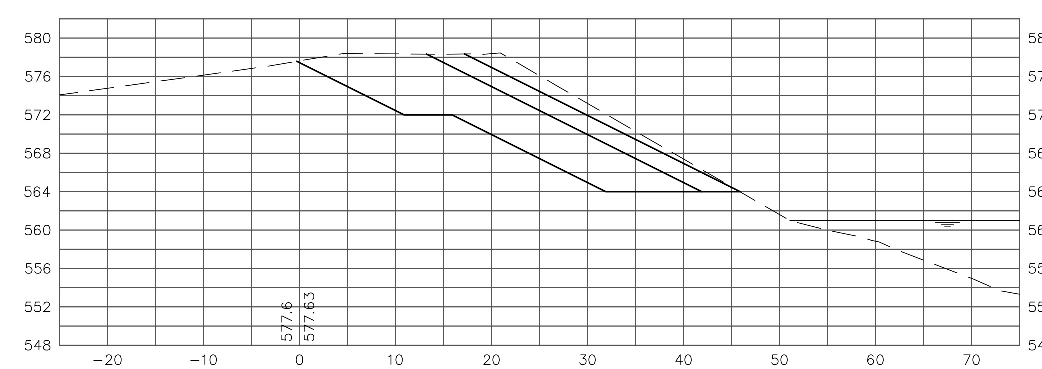

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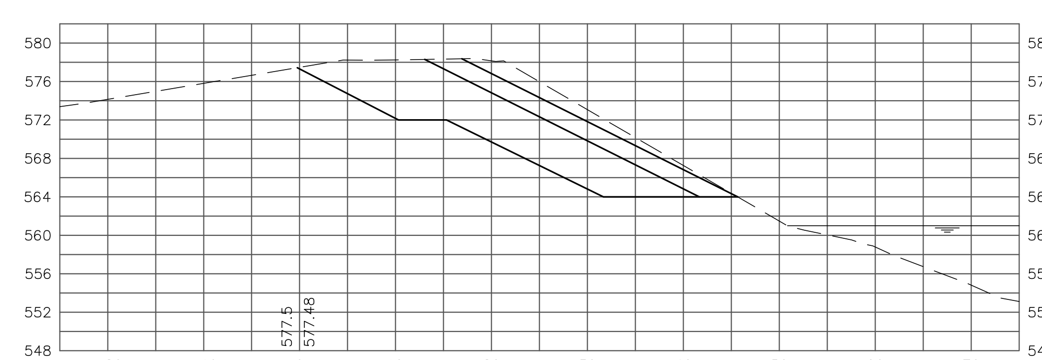

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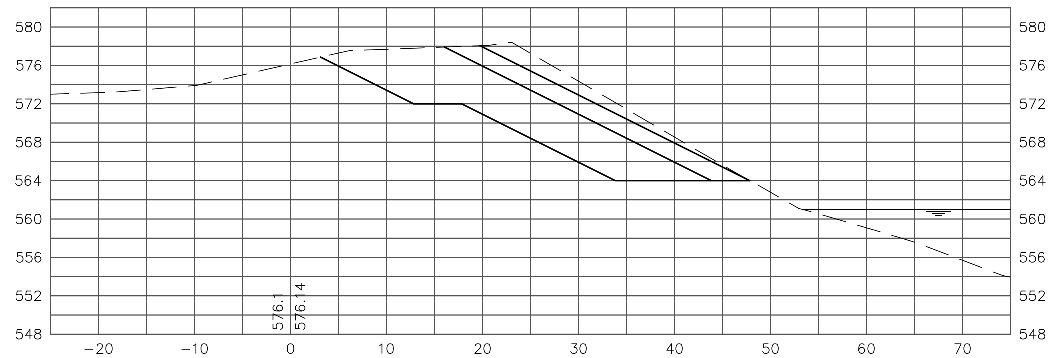

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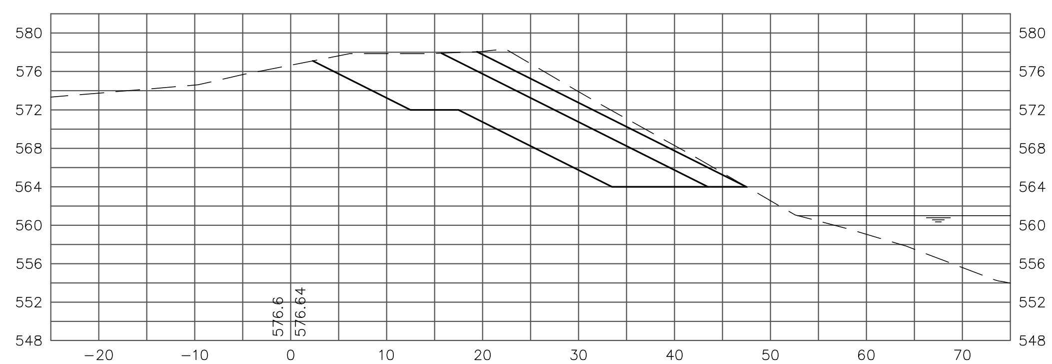

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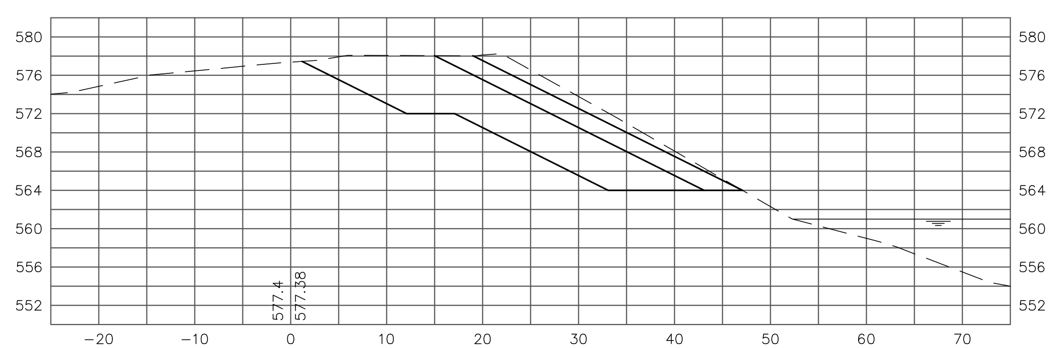

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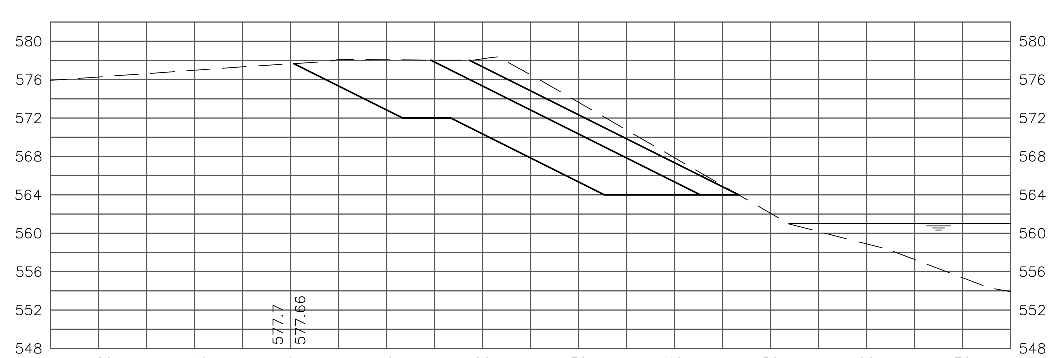

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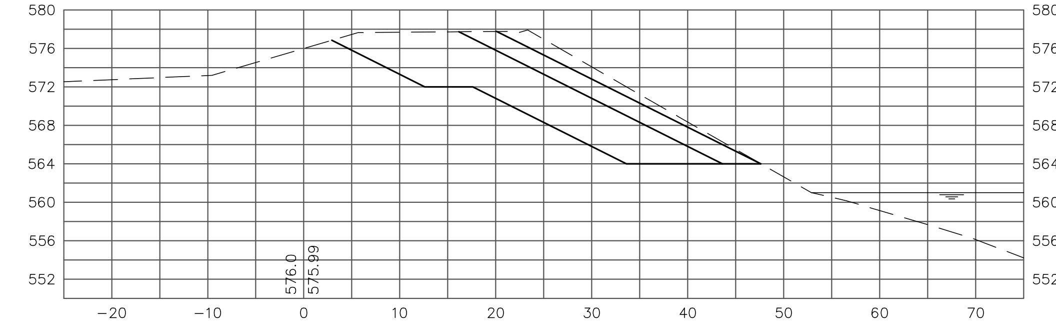

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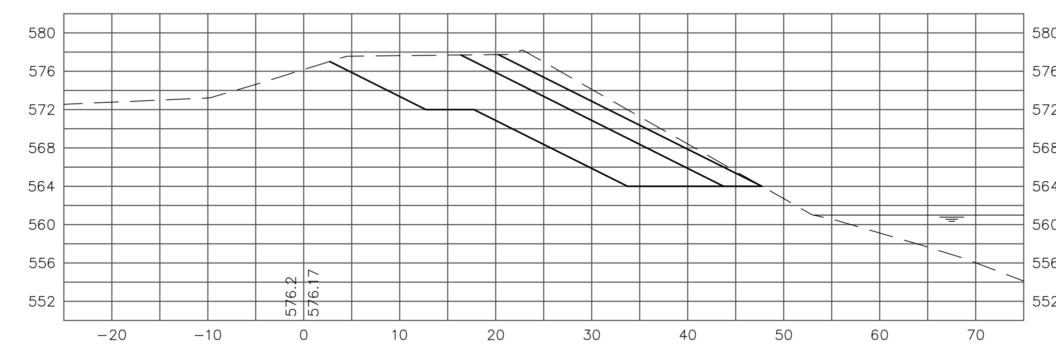

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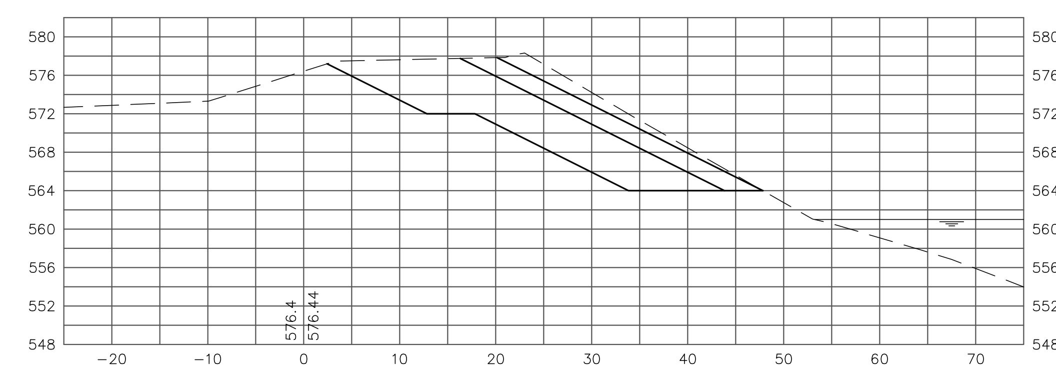

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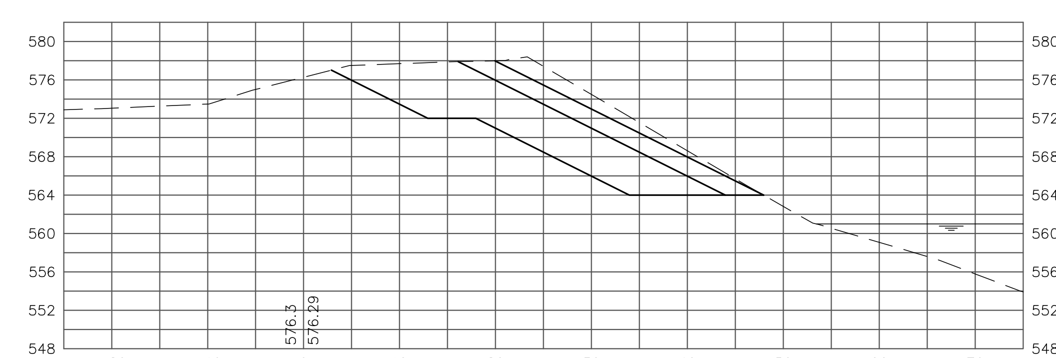

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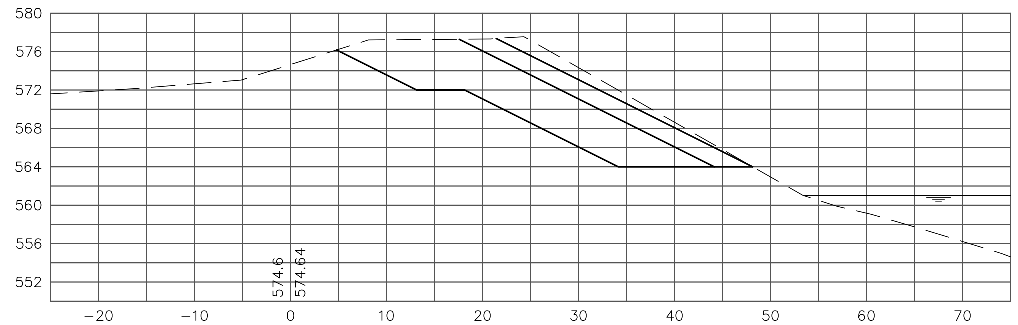

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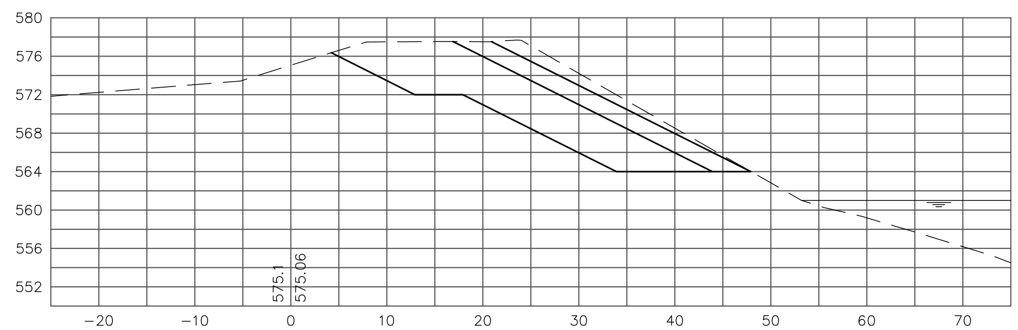

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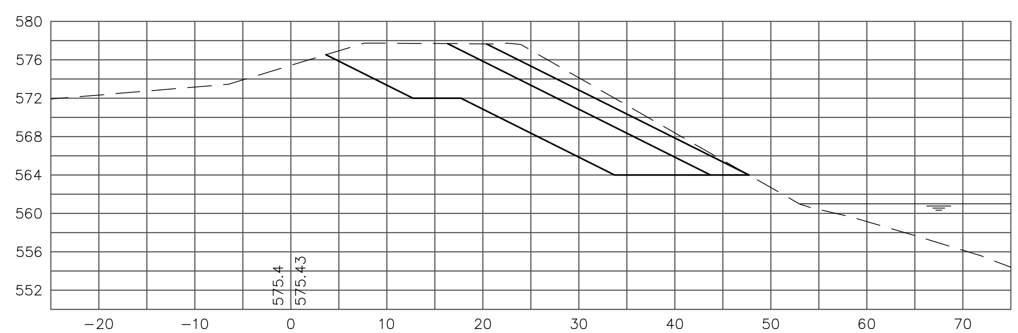

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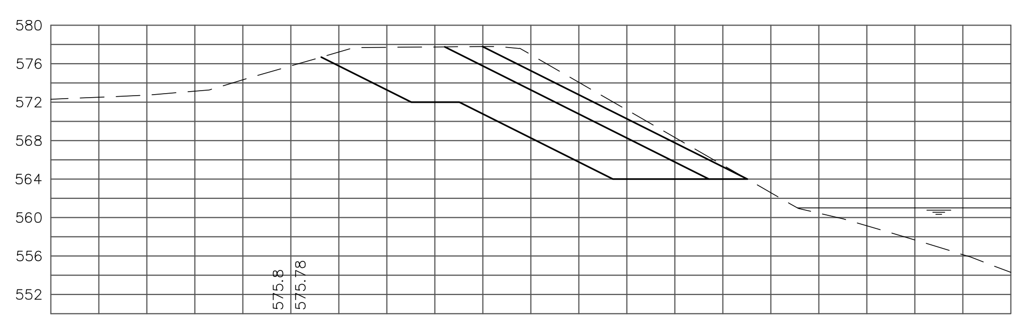

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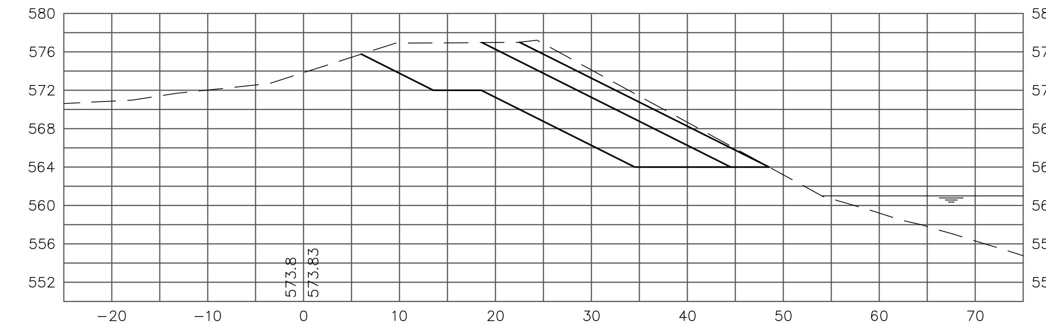

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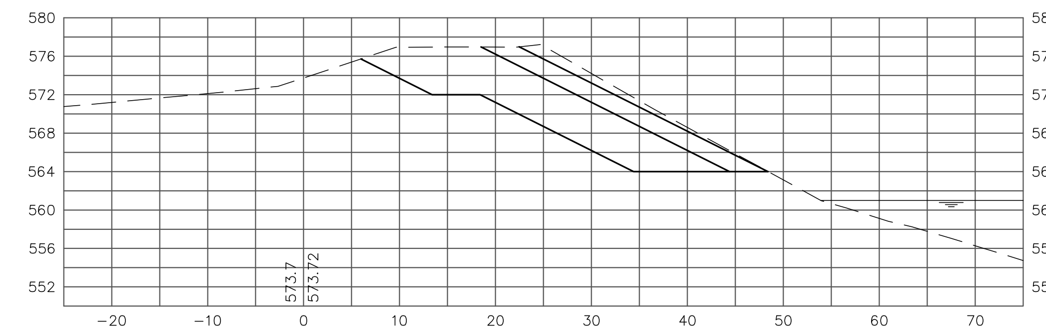

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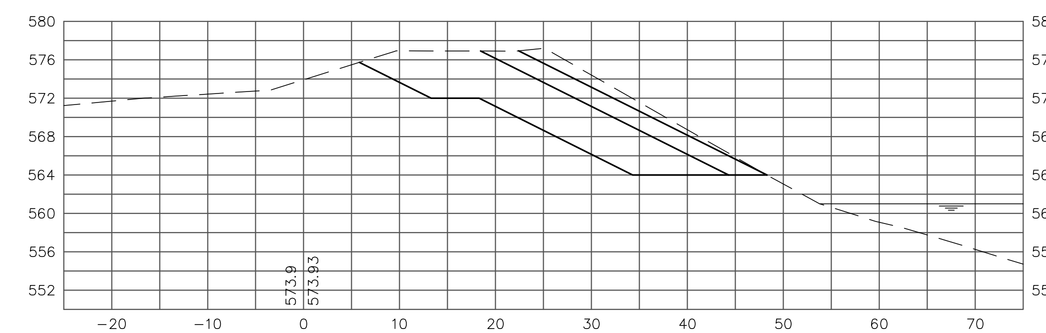

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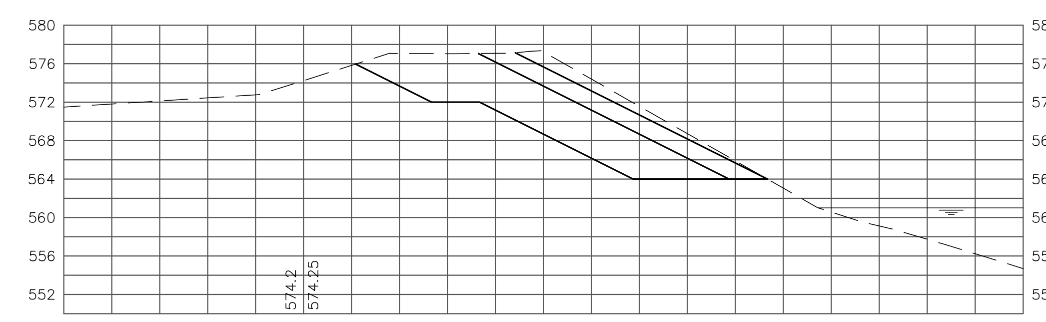

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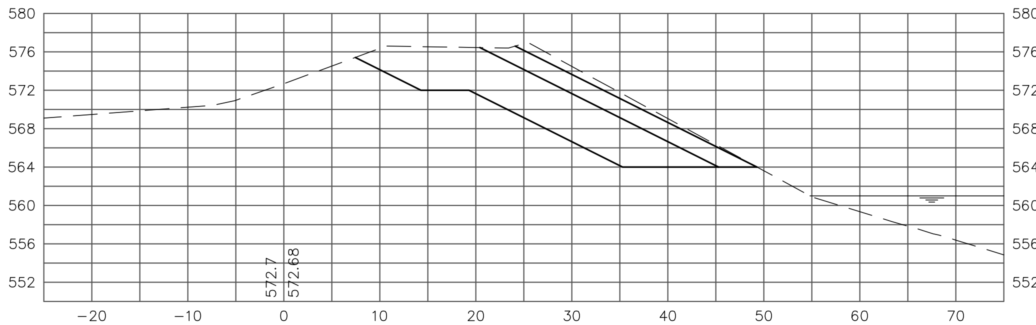

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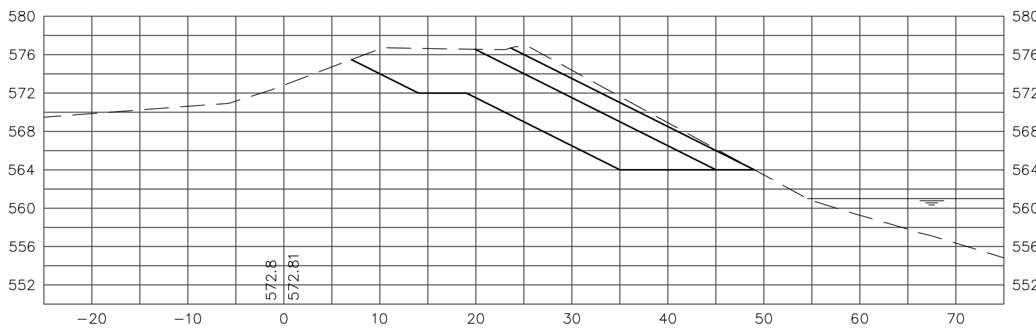

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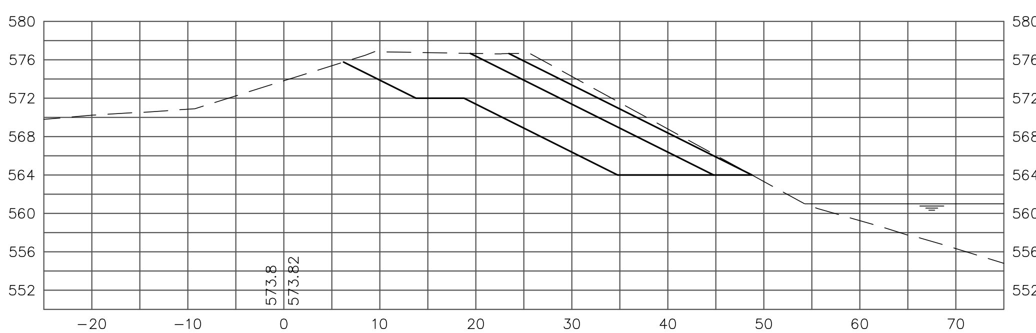

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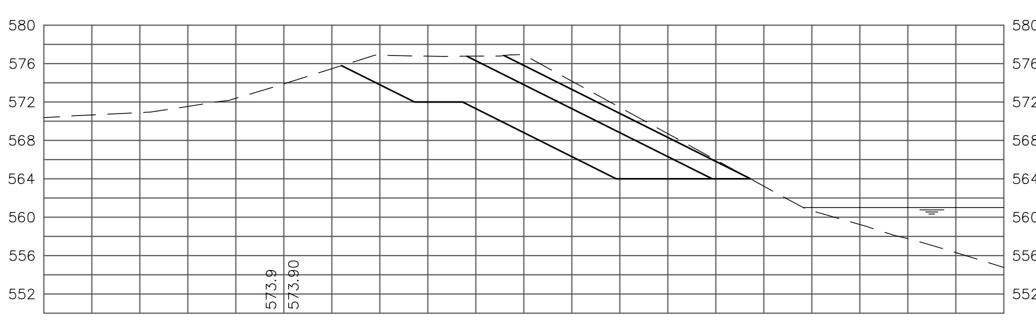

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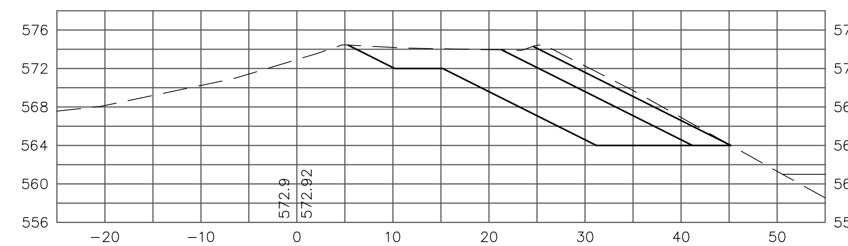

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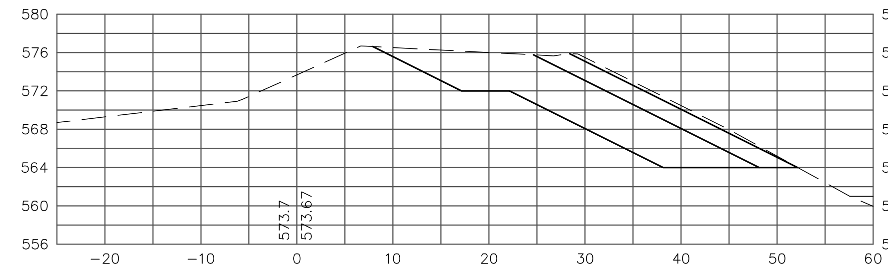

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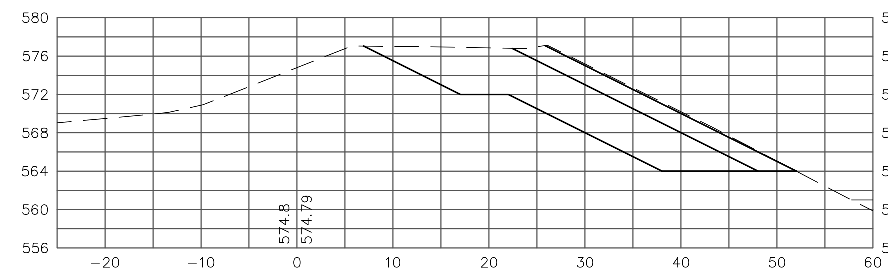

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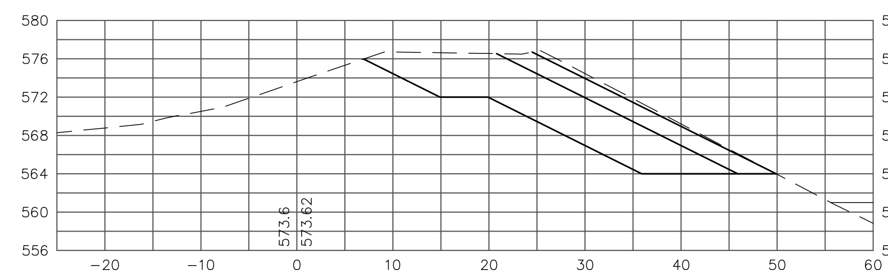

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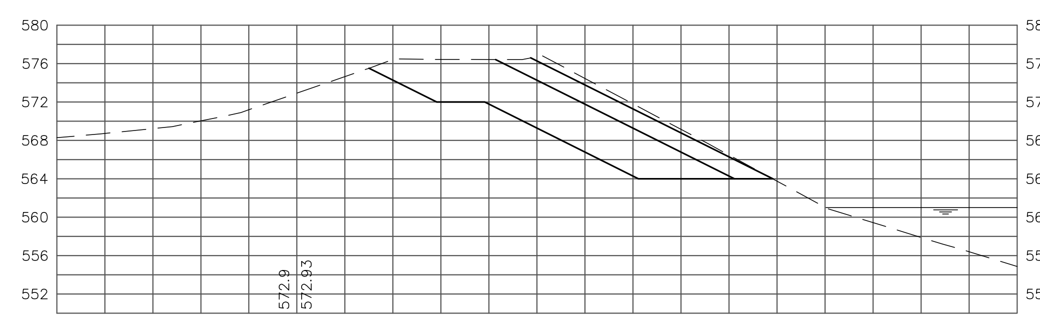

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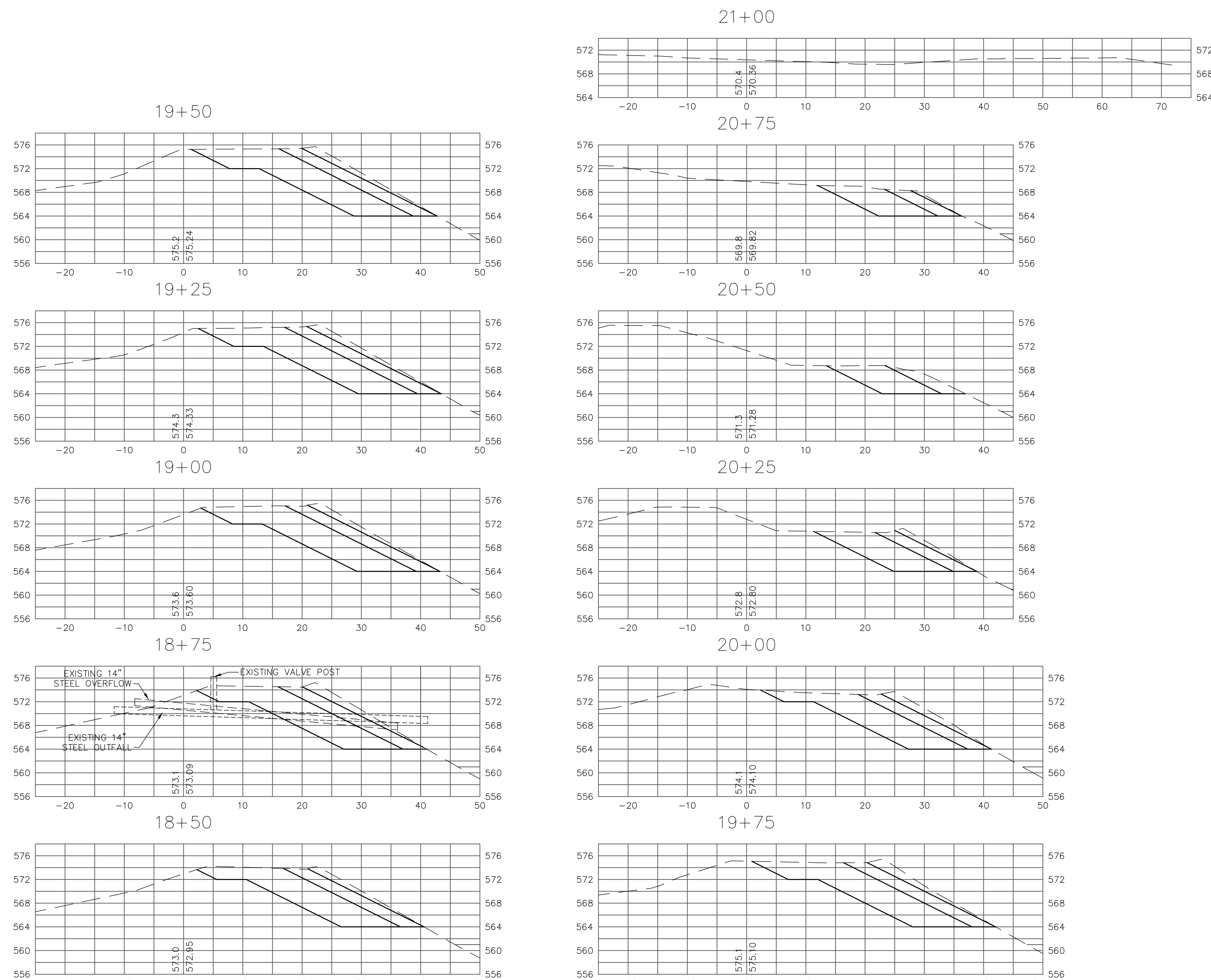

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Geotechnical Engineering Report

South Ash Containment Pond Embankments

Riverside Generating Station

Bettendorf, Iowa

December 7, 2010

Terracon Project No. 07105081/02105081G

Prepared for:

HGM Associates, Inc.
Council Bluffs, Iowa

Prepared by:

Terracon Consultants, Inc.
Bettendorf, Iowa

Terracon

December 7, 2010

HGM Associates, Inc
640 5th Avenue
Council Bluffs, Iowa 51502

Attention: Mr. Terry Smith, P.E.

Re: Geotechnical Engineering Report
South Ash Containment Pond Embankments
Riverside Generating Station
Bettendorf, Iowa
Terracon Project No. 07105081/02105081G

Dear Mr. Smith:

Terracon Consultants, Inc. (Terracon) conducted a subsurface exploration to obtain data to use in performing global stability analyses of selected Ash Containment Pond embankments at the Riverside Generating Station (RGS) as described in our Proposal P07100280 dated September 27, 2010 and our three (3) Supplements to Agreement for Services dated October 11, 2010 and November 5 and 24, 2010. This report presents the findings of the subsurface explorations and provides professional opinions regarding the embankment slope stability.

We appreciate the opportunity to provide geotechnical engineering services for this project and are prepared to provide additional engineering and testing services as recommended in this report.

Sincerely,
Terracon Consultants, Inc.

Kathleen E. Jost
for:

Steven M. Levorson, Ph.D., P.E.
Senior Consultant

Vaughn Rupnow, P.E.
Iowa No. 19259

Attachments

Terracon Consultants, Inc. 15080 A Circle Omaha, Nebraska 68144
P [402] 330 2202 F [402] 330 7606 terracon.com

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EXECUTIVE SUMMARY

Consultants to the EPA are currently conducting an audit of the south ash containment pond located at the Riverside Generating Station (RGS) in Bettendorf, Iowa, which includes evaluation of the pond's embankment stability. MidAmerican Energy Company (MEC) requested Terracon Consultants, Inc. (Terracon) conduct exploration and global stability analyses of the earth embankments that surround the ash pond. Terracon understands this report will be provided to the EPA consultants to assist with their audit. Terracon conducted a subsurface exploration to obtain data concerning subsurface conditions for use in performing the requested global stability analyses of selected Ash Containment Pond embankments located at RGS. Eight (8) borings (B-4 through B-11) were completed to depths ranging from about 24.5 to 30 feet below the existing ground surface. Cone Penetrometer Test (CPT) soundings were conducted to supplement the borings. The approximate boring locations are shown on the Location Sketch in Appendix A (Exhibit A-1). Laboratory tests consisting of index tests and triaxial compression tests were performed on the samples recovered from the borings.

This report presents the findings of the subsurface exploration, the results of our slope stability analyses and our recommendations for remedial work required to increase the stability of the existing embankments. An abbreviated summary of our findings, test results, and recommendations are presented below. This report must be read in its entirety for a comprehensive understanding of our analyses and the limitations of this report.

In summary, the existing embankment sections exhibit factors of safety between 1.2 and 1.3, less than the minimum required 1.4 for the long-term, steady state seepage condition. We recommend removal and replacement of a portion of the riverside slopes with geogrid-reinforced, mechanically stabilized fill. This will increase the global stability factor of safety of the embankment slopes above the minimum requirements of 1.4 for the steady state seepage (long-term) condition and 1.2 for the sudden drawdown (short-term, post-flood) condition. Temporary dewatering during construction will be required to reduce the risk of failure during excavation and slope stabilization/reconstruction. MEC should implement an emergency preparedness plan and weekly inspections during the interim, as recommended in this report.

- For this study, the south pond embankment slope geometry was taken from available plans provided by MEC and survey cross sections supplied by HGM Associates, Inc. (HGM). Material strength properties were developed from laboratory tests conducted on samples obtained from the exploratory borings, published correlations and the in-situ CPT testing. Subsurface geometry was inferred and extrapolated from subsurface conditions encountered at borings conducted along the crest of embankments and available plans of prior construction provided by MEC. Piezometric surfaces were inferred based on elevations of static water surface levels in the pond provided by HGM, short term water levels recorded at borings, and the Mississippi River stage.

- Global stability analyses were performed for the south pond embankment section using the computer program SLOPE/W 2007, version 7.13, by Geo-Slope International. Phreatic water surface levels and pore pressure distributions within the levee sections were developed from simplified seepage models using estimated material parameters and available pool and river level elevations.

- Two (2) design conditions in the US Army Corps of Engineers (USACE) minimum requirements for earthen levees (Table 6.1b from USACE EM 1110-2-1913) were identified as applicable to the existing evaluation: the Steady State Seepage and Sudden Drawdown conditions. Each condition represents differences in river stage, seepage, loading and duration. Each case requires a different minimum factor of safety, each of which need to be satisfied.

- For the Steady State Seepage condition, a minimum factor of safety of 1.4 is required. This is considered the long-term, normal operating condition for the embankment with seepage from the ash pond to the normal operating pool level of the river.

- The Sudden Drawdown condition represents a rapid, post-flood river level drop to normal pool elevation, resulting in a temporary duration, high phreatic water surface within the embankment with increased seepage pressures in the riverside slopes. Based on the use of the historic high flood elevation in the analysis and the consequences of failure of the embankment, a minimum required factor of safety criterion of 1.2 was used for the sudden drawdown analyses.

- According to the USGS, the peak ground acceleration is less than 0.10g for the 100-year earthquake at this site. Therefore, no seismic evaluation is required (EC 1110-2-6067 Paragraph 9h.6).

- Analysis of the existing embankment sections under Steady State Seepage conditions resulted in global stability factors of safety of 1.2 to 1.3, less than the minimum required 1.4 for the steady state seepage condition.

- Options considered to increase the factor of safety included regrading (flattening) the slopes, installing structural reinforcing elements (piers, piles or tieback anchors), in-situ deep soil stabilization (deep soil mixing or jet grouting to create a high strength, cemented stabilized zone in the embankment), placing additional riprap on the existing slopes, and removal and replacement of a portion of the riverside slopes with a higher strength material (cement stabilized fill, or geogrid reinforced/mechanically stabilized fill).

- Flattening the riverside levee slopes provided limited increases in stability without significant relocation of the levee sections (including the crest and roadway) toward the landside, which would require substantial excavation of ash pond materials to construct the flattened sections. Deep structural reinforcement and deep in-situ stabilization techniques are most suited to reinforce against deep-seated instability and are not suited to relatively shallow reinforcement such as was required for these embankment slopes. Placing additional riprap on the existing slopes was found to provide limited increase in factor of safety as this primarily affected the very near surface of the slopes and did not significantly affect the zone of lower stability within the slope.

- Removal and replacement of a portion of the river side slopes with a higher strength material (cement stabilized fill or geogrid-reinforced, mechanically stabilized fill) are recommended to increase the stability of the embankment slopes. These options, shown in Exhibits D-1A and D-1B and described in Section 5, consist of removing and replacing a 10 to 15 foot wide zone along the existing riverward slope face and crest of the levee embankments with stabilized engineered fill material. Analysis of these options resulted in factors of safety greater than 1.4 for the Steady State Seepage condition and greater than 1.2 for the Sudden Drawdown condition (Tables 5 and 6). Based on cost and constructability considerations, we recommend the geogrid-reinforced, mechanically stabilized fill option be implemented.

- Analysis of temporary construction excavation stability indicates dewatering will be required to control seepage through the embankment (from the ash pond to the river) to provide adequate stability during excavation and construction of the stabilized slope face. Failure to provide dewatering would result in high seepage pressures at the toe of the excavated slope and would present a high risk of failure during construction. Analysis of dewatering from a line of pumped wells located along the landside crest of the embankment indicates temporary dewatering during the excavation would provide a factor of safety of approximately 1.4 which is satisfactory for the temporary duration of the excavation and slope reconstruction.

- Dewatering, excavation and reconstruction of the embankment slopes will require favorable weather and river stage conditions. Construction of a soil-cement stabilized fill would require temperatures above 40 degrees Fahrenheit to facilitate cement hydration and allow fill placement. Freezing temperatures during cement stabilization retard cement hydration, reduce strength gain and can disrupt and destroy cement bonding in the compacted material. Likewise, freezing temperatures can prevent proper placement and compaction of structural fill. Freezing temperatures also hamper dewatering efforts, increasing the risk of frozen pipes and blockages that could result in uncontrolled seepage during excavation and construction that could present a high risk of failure during construction.

- Due to weather constraints, in our opinion, construction should not commence until at least the Spring-Summer of 2011 when temperatures are high enough to allow construction of the stabilized slope face. In addition, construction will have to be coordinated with Mississippi River operating pool levels between Lock and Dams 14 and 15 to allow excavation to approximately elevation 564 feet. This will likely provide a narrow time window during the spring or summer to complete construction.

- A preliminary risk assessment of delaying construction to assess the potential for a progressive failure that could breach the existing embankment indicated that if a localized slide of sufficient size did occur during the interim, emergency action remediation consisting of rapidly replacing the failed material with dumped riprap may temporarily stabilize the embankment slope.

- In the interim, until remedial construction is completed, MEC should conduct weekly visual inspections of the levee embankment slopes for signs of movement or distress. MEC should also make necessary arrangements with local quarries to ensure that adequate quantities of riprap are immediately available upon request or provide a stockpiled quantity on site.

- Budgetary cost estimates of the recommended remedial measure options were prepared by HGM Associates and are provided in a separate document.

- The evaluations presented in this report are based on available plans and construction information provided by MEC as augmented by subsurface exploration and testing performed during this study. As-built information in MEC's files regarding the various stages of construction is limited and estimates regarding cross section geometry and material zone properties were required to complete our evaluations. Opinions of global stability are based on simplified models developed as described in this report.

- In accordance with USACE EC 1110-2-6067 guidance, the maximum period of validity of this evaluation is 10 years. Reevaluation of the levee embankments will be required prior to that time. If a deficiency becomes known, or information becomes available that invalidates the assumptions or information relied on in preparing this report, or if hydrologic conditions change, the conclusions of this report are considered invalid.

GEOTECHNICAL ENGINEERING REPORT
SOUTH ASH CONTAINMENT POND EMBANKMENTS
RIVERSIDE GENERATING STATION
BETTENDORF, IOWA

Terracon Project No. 07105081/02105081G
December 7, 2010

1.0 INTRODUCTION

We understand that consultants to the EPA are currently conducting an audit of the south ash containment pond located at the Riverside Generating Station (RGS) in Bettendorf, Iowa. MidAmerican Energy Company (MEC) originally requested that Terracon Consultants, Inc. (Terracon) conduct a limited exploration and cursory assessment of global stability of the earth embankments that surround the ash pond based on the limited data available. Terracon prepared and presented a preliminary report of those analyses dated October 27, 2010 which indicated the existing ash pond embankments did not meet the requirements for earthen levees as set forth by the US Army Corps of Engineers (USACE) for global stability under steady state seepage conditions. Terracon recommended additional exploration, testing and analyses be performed to refine the preliminary assessments and prepare recommendations for remediation, where required. MEC subsequently authorized HGM Associates and Terracon to conduct additional exploration, testing and analysis to address the concerns discussed in the preliminary report. Terracon understands this report will be provided to the EPA consultants to assist with their audit.

Terracon conducted limited subsurface explorations to obtain data concerning subsurface conditions for our use in performing the global stability analyses of selected Ash Containment Pond embankments located at RGS. Eight (8) borings (B-4 through B-11) were completed to depths ranging from about 24.5 to 30 feet below the existing ground surface. Four (4) Cone Penetrometer Test (CPT) soundings and several Vane Shear Tests (VST) were conducted to supplement the borings. Additional index property tests and laboratory shear strength tests were performed to better estimate shear strength parameters for use in the analysis. Logs of the borings along with a Boring Location Sketch (Exhibit A-1) are included in Appendix A of this report. Laboratory test results are included in Appendix B of this report.

This study was performed in general accordance with our proposal (Terracon No. P07100280) dated September 27 and our three (3) Supplements to Agreement for Services dated October 11, 2010 and November 5 and 24, 2010.

2.0 PROJECT INFORMATION

2.1 Project Description

	Description
Background	Consultants to the EPA are currently conducting an audit of the south ash containment pond located at the Riverside Generating Station (RGS) in Bettendorf, Iowa. MidAmerican Energy Company (MEC) requested Terracon conduct analyses of slope stability of the levees surrounding the ash ponds. MEC will provide our report to the EPA consultant for their consideration during the audit.
Limitations of this Study	The evaluations presented in this report are based on available plans and construction information provided by MEC as augmented by subsurface exploration and testing performed during this study. As-built information in MEC's files regarding the various stages of construction is limited and estimates regarding cross section geometry and material zone properties were required to complete our evaluations. Opinions of global stability are based on simplified models developed as described in this report. In accordance with USACE EC 1110-2-6067 guidance, the maximum period of validity of this evaluation is 10 years. Reevaluation of the levee embankments will be required prior to that time. If a deficiency becomes known, or information becomes available that invalidates the assumptions or information relied on in preparing this report, or if hydrologic conditions change, the conclusions of this report are considered invalid.
Additional Information	On September 23 and 24, 2010, representatives of Terracon and MEC met at the site to select and stake boring locations based on visual observations of current conditions. On November 23, 2010, additional boring locations were selected and staked based on results of the preliminary borings performed on September 23 and 24. HGM provided survey cross-sections of the levees, extending into the pond area and beyond the toe on the opposite side from the pond. MEC also provided prior survey and construction plan information included in Appendix C of this report. MEC also provided additional documents reflecting construction proposals for some stages of embankment construction (included in Appendix C). A 1992 research report prepared by Iowa State University provided additional information regarding ash material characteristics at RGS.

2.2 Site Location and Description

Item	Description
Location	The south ash containment pond is located south of the Riverside main plant structure along the west bank of the Mississippi River in Bettendorf, Iowa.
Pond Embankment/ Levee Descriptions	Terracon understands that the ponds at RGS are utilized primarily for bottom ash disposal which is deposited in the ponds in a wet condition (sluiced). Terracon understands that RGS has been in operation since the early 1900's. The south pond is surrounded on three sides by an embankment/levee that extends into the Mississippi River.

Item	Description
	Based on partial plans provided to us, it appears the original pond embankment/levee was constructed in 1968 with a crest elevation of 563.4 ft. Based on MEC records, it appears the original levee was constructed by dumping riprap into the Mississippi River. The levee section was apparently raised and widened three times since the original construction (1970, 1972 and sometime between 1977 and 1980), resulting in a current crest elevation of approximately 580+/- feet. Repairs consisting of partial reconstruction and grout injection are referenced on undated plans. Regrading of the riverside slope and construction of a rip rap covered erosion control slope face was completed in 2001. According to MEC, no erosion or bank sloughing has been observed since the regrading and riprap erosion control measures were implemented in 2001. Based on our field observations, the river side of the embankments appeared to be essentially free of vegetation and in reasonably good condition with no apparent visible erosion channels or sloughing. However, the pond side of the embankment was partially vegetated and could not be observed for obvious indications of erosion or other issues. MEC has reported that the pond side of the embankment has since been mowed. We understand that the embankments and levees are maintained by MEC.

2.3 References and Supporting Documents

Engineering manuals, design guidance, reports, and literature used in our analysis are included in the list of references in Appendix C. Plans and documents provided by MEC are also included in the Supporting Documents in Appendix C.

3.0 SUBSURFACE CONDITIONS

3.1 Regional Geology

This site lies within the Mississippi River floodplain. The natural soil profile in this area consists of alluvial deposits of silt, clay, sand and gravel overlying limestone, dolomite, and shale associated with the Wapsipinicon Formation of Devonian bedrock.

3.2 Available Cross Section Drawings

Available as-built and/or historic design cross section data provided by MEC were limited. Figures 1 and 2 in this section of the report are excerpts from a plan sheet titled "Riverside South Fence and Ash Fill Area" from Iowa-Illinois Gas and Electric Company drawing No. 22-500-108-012, originally dated 27-Mar-67, latest revision dated 18-Nov-77. A copy of this drawing is included in Appendix C (Exhibit C-7).

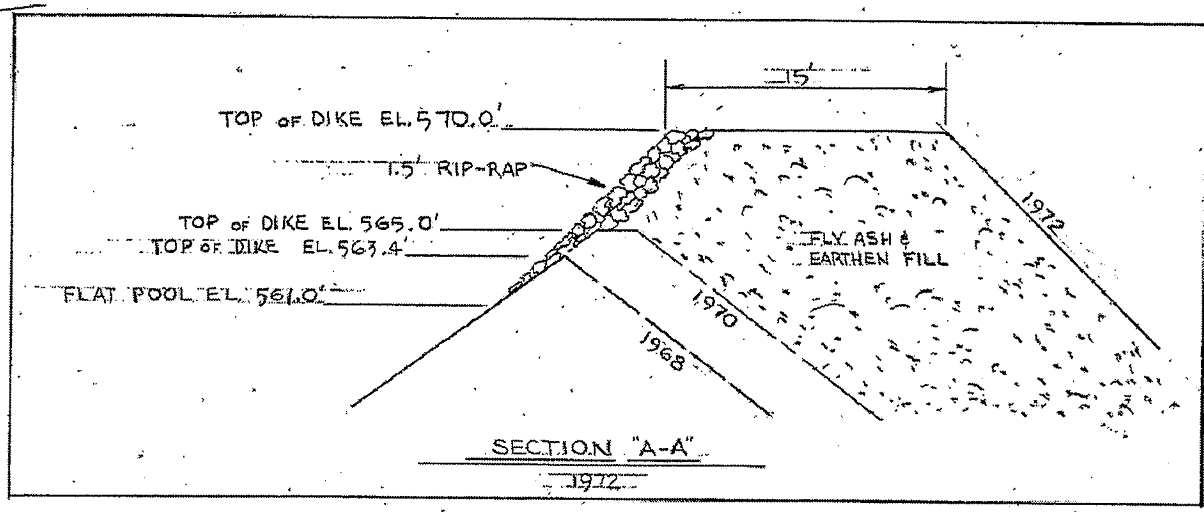


Figure 1. Section A-A, 1972 from Riverside South Fence and Ash Fill Area, Iowa-Illinois Gas and Electric Company drawing No. 22-500-108-012.

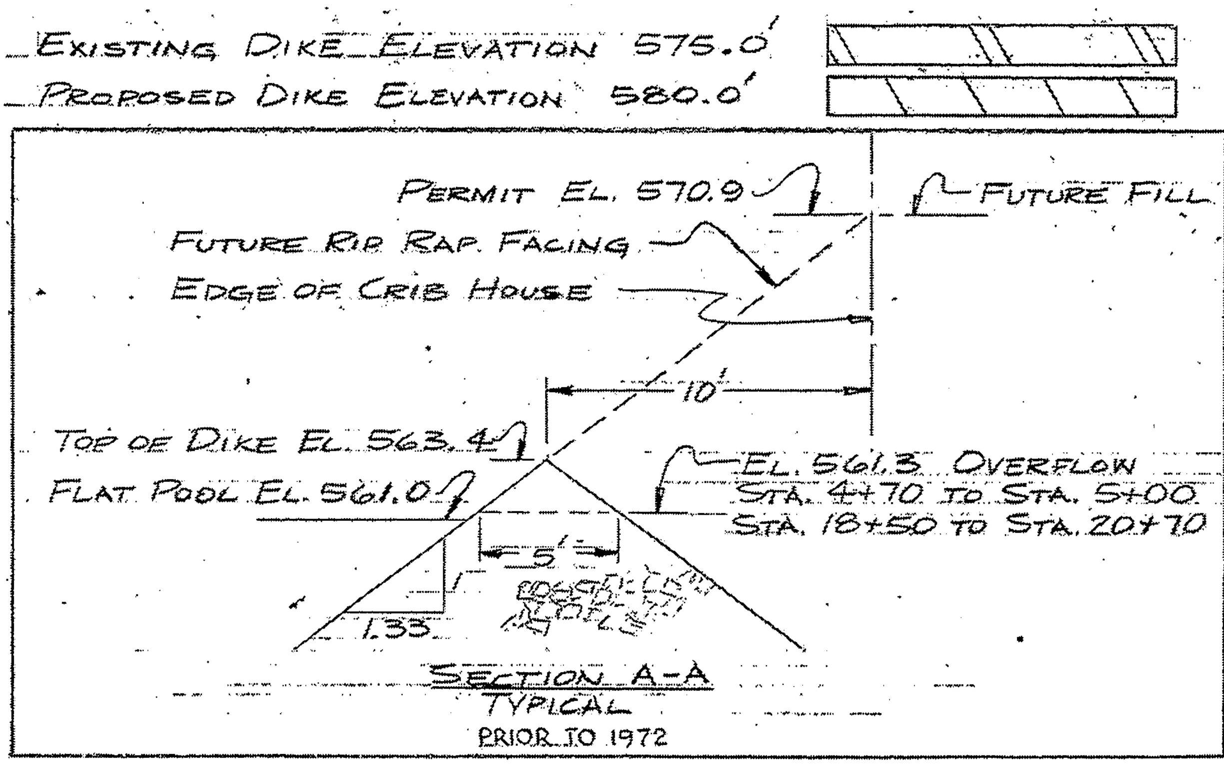


Figure 2. Section A-A at Crib House, Prior to 1972 from Riverside South Fence and Ash Fill Area, Iowa-Illinois Gas and Electric Company drawing No. 22-500-108-012.

Figure 3 shows the typical section detail from Drawing No. 20, titled "Remediation of Dike Erosion Typical Cross Section" prepared by Indeco for MEC, dated 03-Aug-01 (Exhibit C-11).

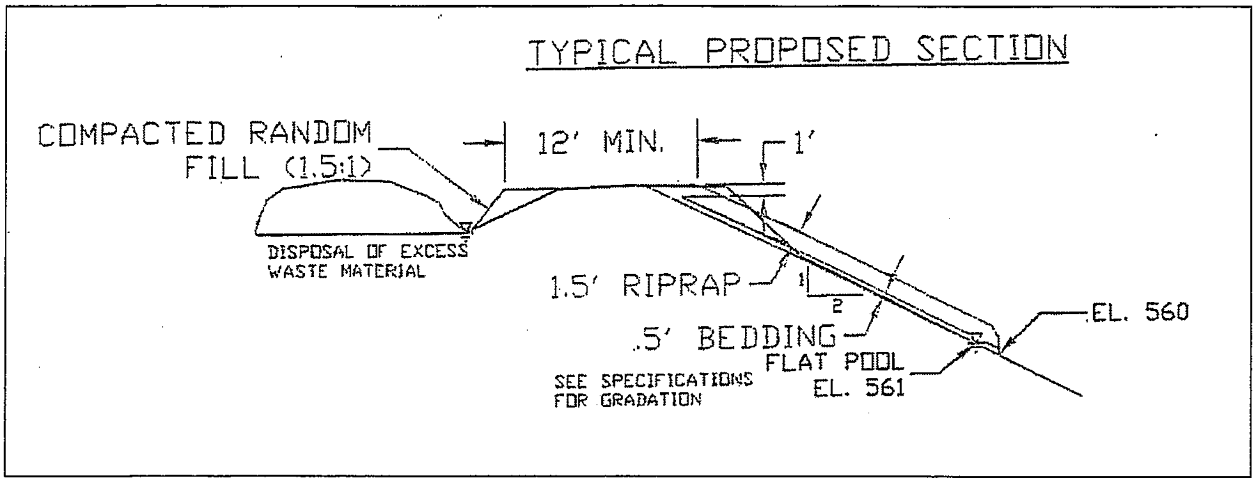


Figure 3. Typical proposed section from Remediation of Dike Erosion Typical Cross Section, Drawing No. 20 by Indeco, dated 03-Aug-01.

HGM Associates provided surveyed cross sections designated Sections A-E. These sections are included in Appendix C (Exhibit C-6) and their locations are shown on the appended Site Plan (Exhibit C-5).

3.3 Previous Subsurface Explorations and Data

MEC provided a boring location plan, hydrogeologic cross sections and boring/well logs for five (5) borings performed in 2008 to install monitoring wells. This information is included in Appendix C (Exhibits C-17 to C-25). We were also provided with an annotated plan sheet showing locations along the levee where the notes indicate grout holes were drilled and pumped. The sheet is undated and untitled. No logs of the drill holes, grout volumes or depths were available. The sheet is included in Appendix C (Exhibit C-14).

3.4 Subsurface Exploration

Eight (8) borings and four (4) CPT soundings were conducted by Terracon from the levee crest for this exploration. Field exploration procedures are described in page A-21 of Appendix A of this report. Logs of the borings and soundings are also included in Appendix A. Typical subsurface conditions interpreted from the subsurface exploration and available cross section data are described in Table 1. Slope stability analysis cross sections in Appendix D of this report, using simplified stratigraphy, were developed by extrapolating conditions encountered at the boring/sounding locations. Actual in-situ conditions are much more complex due to the heterogeneous nature of the materials, variable modes of deposition and sequences of construction.

Table 1. Typical Subsurface Conditions Interpreted from the Subsurface Exploration

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/ Density
Stratum 1 (Post 1972 Levee)	8 to 12 feet	Mixture of Ash and Soil USCS Classification ML (Silt) with varying proportions of clay, sand and gravel	Very Loose to Medium Dense
Stratum 2 (Ash deposits)	16 to 20 feet	Mixture of Ash and Soil USCS Classification ML (Silt) to CL (Lean Clay) with varying proportions of clay, sand and gravel	Very Loose to Loose – Very Soft to Soft
Stratum 3 (1972 Levee)	26 to 27 feet	Mixture of Ash and Soil USCS Classification ML (Silt) with sand and gravel, trace clay	Loose to Medium Dense
Stratum 4[1] (Rock)	28½ feet	weathered limestone	NA

1. Extended to the termination depth of the borings

Due to the location of the borings on the crest of the existing levee, the borings do not appear to have encountered the original 1968 levee section or the 1970 levee widening, which now form the toe of the existing levee section due to the subsequent enlargement of the levee toward the landside (see Figure 1). A review of records by MEC show that pre-construction proposal documents indicate the contract required the use of rip-rap for construction of the 1968 levee section. The construction specifications that were supplied to vendors at bid specified "mine run quarry rock". An August 5, 1963 RGS cost estimate for the 1968 levee indicates the levee was to be constructed in the Mississippi River out of riprap and extend from the Riverside Station to the ALCOA screen house. The estimated quantity of riprap required was 13,159 cubic yards. A June 1967 summary of bids for the project indicates the levee was planned to be constructed by dumping the riprap from barges in the river. Based on the estimated quantities of riprap and proposed alignment, we estimate that the riprap quantity would be sufficient to construct a 7 to 8 foot tall levee dike with 2:1 side slopes. These dimensions are consistent with the plan dike top elevation shown for the 1968 levee and the surveyed Mississippi River bottom (alluvium) elevations.

3.5 Water Level Observations and River Data

The boreholes were observed while drilling for the presence and level of groundwater. The water levels observed are noted on the attached boring logs, and are summarized in Table 2. The boreholes were grouted after drilling using a cement-bentonite mixture. A relatively long period of time is necessary for water levels to develop and stabilize in a borehole. Longer term monitoring in cased holes or piezometers would be required for a more accurate evaluation of the groundwater conditions.

Table 2. Water Levels Observed in the Borings

Boring Number	Observed Water Depth (ft)[1] While Drilling
4	14
5	18
6	16
7	11
8	8
9	12
10	20
11	14.5

1. Below existing grade

The 2008 groundwater monitoring well boring logs provided to us show water levels in a similar range to those encountered in the current exploratory borings.

Fluctuations of the water levels will occur due to fluctuations in the water level of the Mississippi River, ash pond water levels, seasonal variations in the amount of rainfall and runoff, and other factors not evident at the time the borings were performed. Subsurface water levels over the life of the embankments will be higher or lower than the levels indicated in the boring logs.

Ash pond water level data were provided to us by HGM Associates and MEC. Based on the surveyed water levels in the pond and data regarding outflow works elevations, water levels in the pond are expected to exhibit little variation over time. Ash pond water levels used in our analyses were considered to vary from 572.5 to 574 feet (north to south).

Available river level data were obtained from USGS gage stations at Dams 14 and 15 on the Mississippi River as documented by the USGS in their website. Based on these data, an operating pool level of 561 feet was used in our analyses for normal river level conditions. We considered flood stage elevation as 568 feet and maximum historic flood stage as 572 feet.

3.6 Field and Laboratory Test Results

Laboratory test procedures and laboratory test results are presented in Appendix B of this report. Due to the loose, silty texture of the ash embankment materials and the presence of groundwater, a number of field SPT tests yielded very low blowcounts (less than 3 blows per foot) and "weight of hammer" (WOH) results. Adjacent CPT tests yielded low, but measurable tip resistance measurements. Visual examination of the samples obtained with the SPT sampler indicated very silty texture, very loose relative density and high moisture content. Comparison of the low blowcounts and adjacent CPT data suggest that the material may have liquefied locally at the tip of the hollow stem augers due to upward flow of groundwater into the hollow stem augers, resulting in a potential disturbed zone in the SPT sampling interval. Due to the inconsistency in these data and the questions regarding the potential for disturbance affects in the SPT data, we chose to conduct a series of laboratory shear strength tests on remolded samples of these materials to develop design strength parameters for the analyses.

To develop design shear strength parameters for global stability analyses, three (3) sets of Isotropically Consolidated-Undrained Compression Triaxial Shear tests (CIUC) with pore pressure measurements were performed on remolded samples of the embankment materials obtained from the borings. The remolded samples were compacted in the laboratory to a loose state to represent a lower bound density condition similar to the densities observed in the existing embankment.

Atterberg limits and gradation (hydrometer) analyses were performed on each remolded sample and on selected samples obtained from the borings. The results of these tests are presented in Appendix B. The majority of samples classify as silts based on texture and plasticity. The range of permeability of the ash materials encountered in the borings was evaluated based on the gradations and on evaluation of the pore water pressure dissipation tests performed in the CPT soundings. Based on these data, the permeability of the ash materials was estimated to range from about $1(10)^{-3}$ cm/sec to $1(10)^{-5}$ cm/sec.

3.7 Design Shear Strength Parameters and Material Properties

Results of the CIUC triaxial shear tests performed on remolded samples of the levee embankment materials are shown in Figure 4 on page 9 in Modified Mohr-Coulomb form. Due to strain softening behavior in one set of tests (B-8 & 9/Composite), all test results were evaluated for high strain (15% axial strain) conditions, representing the lowest developed friction angles for the materials. Although one test series exhibited a small cohesion intercept (B-10, 13-18 ft. depth), the composite, design strength envelope shown in Figure 4 was evaluated with effective cohesion set to zero. These data were used to establish probable design shear strength parameters for the embankment materials. The data for individual tests shown in Figure 4 are summarized in Table 3.

Based on these shear strength test results, the drained friction angle of the 1972 and the post-1972 levee enlargement zones was assigned a value of 35 degrees with a drained cohesion of zero.

Table 3. Summary of CIUC Triaxial Shear Test Data

Boring	Sample Depth, ft	Specimen	Remolded Dry Density, pcf	Consolidated Saturated Density, pcf	c' psf	ϕ' degrees
B-10	13-18	A	88.9	118.9		
B-10	13-18	B	88.6	119.9	30	34.5
B-10	13-18	C	86.3	119.7		
B-8 & 9	15-22.5	A	70.6	106.1		
B-8 & 9	15-22.5	B	70.6	106.2	0	37.0
B-8 & 9	15-22.5	C	71.1	106.7		
B-8	5-7	A	69.3	104.8		
B-8	5-7	B	69.4	105.2	0	36.4
B-8	5-7	C	69.0	105.3		
		Average	**76.0**	**110.3**	**10**	**35.9**

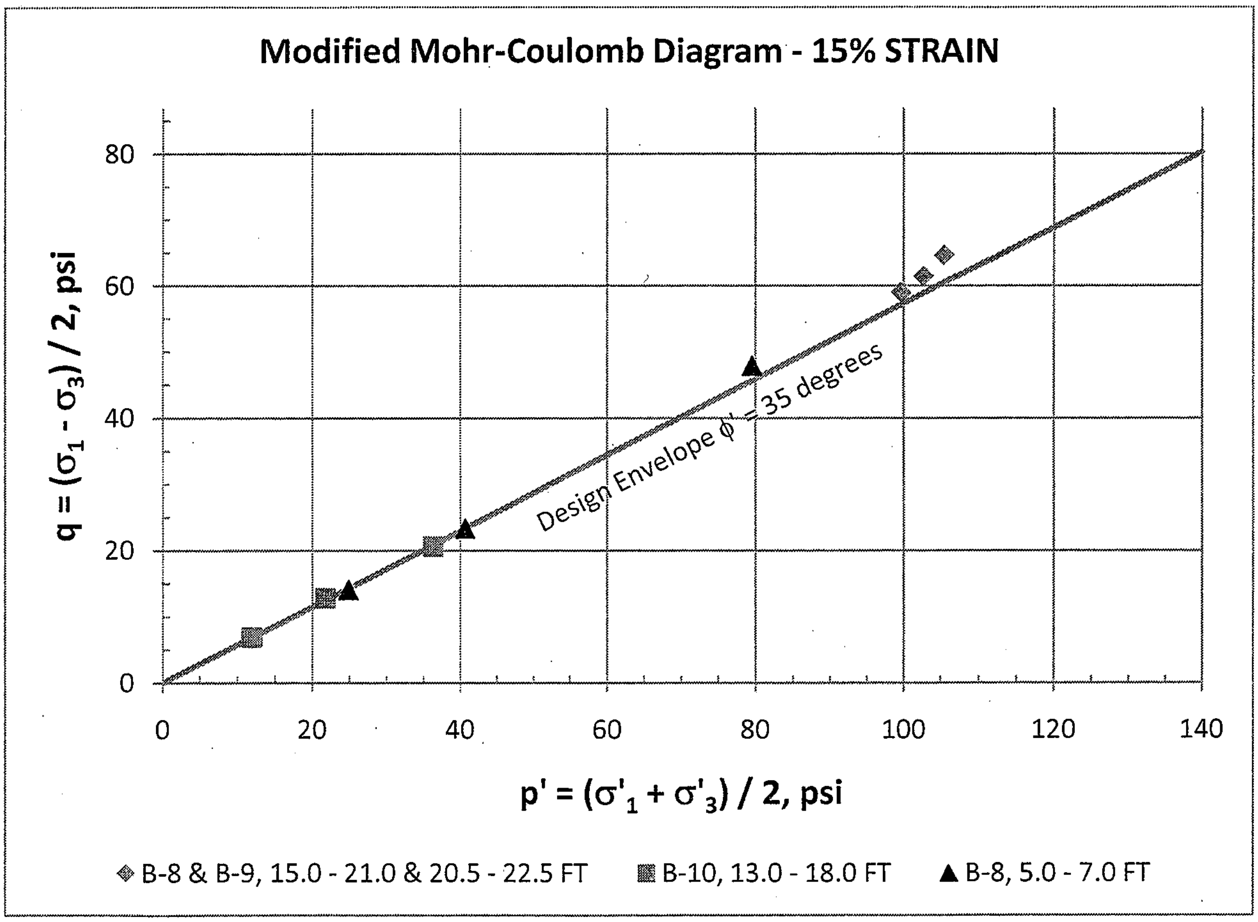


Figure 4. Design Shear Strength Envelope for Remolded Ash Samples.

As discussed in Section 2.2, we understand the ash pond contains primarily bottom ash, deposited by sluicing. Based on previous experience with similar deposits, the ash materials contained by the embankments is anticipated to consist of random zones and layers of coarse and fine grained ash deposits. Coarser materials would settle out closer to the sluice outlet and finer materials would settle out farther from the location of the outlet at the time of deposition.

A research study that was performed at Iowa State University in 1992 on bottom ash samples obtained from the west side of the ash pond (Bergeson et al., 1992) to evaluate the material for potential use as structural fill and as a pavement base material was used as the basis for estimating design strength parameters for the ash pond deposits. Based on the results of the Iowa State University study, the sandy silt graded ash exhibited a remolded, drained friction angle of 32 degrees and an apparent cohesion of 7 psi. For purposes of this levee embankment evaluation, the design strength envelope of the ash deposits was taken as 32 degrees with zero cohesion.

The zone of material encountered in the borings between the lower 1972 embankment enlargement and the upper, post-1972 embankment enlargement (between 10+/- to 16+/- feet deep) exhibited variable silt to clay like behavior in the borings and CPTs. It appears this zone of material is likely the result of backwater, fine-grained sedimentation of mixed fine ash deposits (silt texture) and lean clays. The drained friction angle for this zone was estimated as 30 degrees based on correlation with loose silt to low plasticity/low clay content soil behavior (EM 1110-2-1913; Stark et al., 2005)

As discussed previously, the limited as-built information regarding the original 1968 levee section indicates this levee was constructed in the Mississippi River by dumping riprap from barges. Given that no apparent filter layer was constructed between the ash pond and riprap levee section, we anticipate that the existing section may consist of riprap with ash filling the interparticle voids. We have assigned a drained friction angle of 38 degrees to this zone.

Mississippi River alluvium that is anticipated to exist beneath the levee and form the bed deposits of the river was estimated to consist of loose silts and sands and soft clay soils. The drained friction angle of these deposits was estimated at 30 degrees for purposes of our analyses.

4.0 GLOBAL STABILITY ANALYSES

4.1 Analysis Methodology

Stability analyses were performed for the five (5) cross sections using the computer program SLOPE/W 2007, version 7.13, by Geo-Slope International. The analyses were conducted using the Morgenstern-Price methodology using a search routine to identify circular failure arcs in the riverside slopes. Due to the relatively free draining nature of the embankment and ash materials, all analyses were conducted using effective stress analyses with pore pressures estimated from flow modeling and/or estimated phreatic surfaces.

4.2 Analysis Cases and Criteria

For evaluation of existing levee embankments, five (5) design conditions are identified by USACE for slope stability analysis. Each design condition represents a different loading condition or river stage event. For purposes of this evaluation, three (3) of the design conditions were considered to be inapplicable. The End of Construction condition is not applicable to evaluation of an existing embankment where enlargement is not being considered. The Intermediate River Stage condition and Steady State Seepage conditions were found to be identical due to the controlled water level elevation in the ash pond and the resulting direction of flow (riverward) in both cases. According to the USGS, the peak ground acceleration is less than 0.10g for the 100-year earthquake at this site. Therefore, no seismic evaluation was required (EC 1110-2-6067 Paragraph 9h.6).

The two (2) design conditions considered applicable to this evaluation were the Steady State Seepage and Sudden Drawdown conditions. Each condition represents differences in river stage, seepage, loading and duration. Each case requires a different minimum factor of safety, each of which need to be satisfied. The two (2) design conditions considered in this evaluation and their minimum factor of safety requirements are discussed in the following paragraphs. The results of these analyses are discussed in subsequent sections of the report.

Based on guidance provided in EM 1110-2-1902, "Slope Stability" and EM 1110-2-1913, "Design and Construction of Levees," we evaluated the riverside slopes of the existing embankment sections under conditions of Steady State Seepage from the ash pond to the operating river level. The minimum required factor of safety for this analysis case was taken as 1.4 in accordance with guidance presented in Table 6.1b (EM 1110-2-1913). Following review of these analyses, which indicated the existing embankment configuration did not meet the required factors of safety, we analyzed conceptual cross sections that included conceptual repair/remediation measures under conditions of Steady State Seepage for a minimum factor of safety of 1.4.

The conceptual repair/remediation measures were also analyzed under conditions of Rapid or Sudden Drawdown. This condition represents a rapid, post-flood river level drop to normal pool elevation, resulting in a temporary duration, high phreatic surface within the embankment with increased seepage pressures in the riverside slopes. The minimum factor of safety guidance for the Sudden Drawdown case is variable, depending on the conservatism applied in establishing the design flood elevation, shape of phreatic surface, consequences of failure, method of analysis and other factors. The guidance provided in EM 1110-2-1902 indicates minimum factors of safety should be selected between 1.1 and 1.3 depending on the flood stage evaluated and the method of analysis used. EM 1110-2-1913 indicates the minimum factor of safety under sudden draw down condition should be greater than 1.0. Based on the use of the historic high flood elevation in the analysis and the consequences of failure of these embankments, we selected a minimum required factor of safety of 1.2 criterion for the sudden drawdown analyses.

4.3 Groundwater Seepage and Pore Pressure Distribution

Water levels used as boundary conditions in the ash pond and the river were as previously discussed in Section 3.5 of this report. Pore water pressures within the embankment for steady state seepage stability cases were analyzed for each cross section using the computer program SEEP/W 2007, version 7.13, by Geo-Slope International. The analyses considered the embankment materials to have an average isotropic coefficient of permeability of $1(10)^{-4}$ cm/sec based on correlation with USDA textural classifications and results of field permeability testing published by the USDA US Salinity Laboratory (USSL), Riverside, California. The resulting pore water pressure distributions were imported into the slope stability models prior to conducting slope stability analysis.

For analysis of cases involving sudden drawdown from a river flood stage to normal operating pool level, water levels in the embankment were considered to have stabilized between the ash pond water level and the river flood level prior to drawdown. For our analyses, the drawdown was allowed to happen instantaneously (worst case scenario). The resulting phreatic surface in the embankment was allowed to remain at a high level similar to the static flood elevation and closely follow the riverside slope (worst case instantaneous phreatic surface without drainage). This phreatic surface was input into the stability models to estimate drained pore pressures in the stability analyses. Given the estimated permeability of the embankment materials based on textural classification, the stability analyses for sudden draw down cases were conducted using effective stress parameters and pore pressures based on the assigned phreatic surface. According to EM 1110-2-1902, this approach is considered an acceptable alternative for free-draining materials.

4.4 Results of Analyses

The existing embankments were found to have factors of safety less than the 1.4 minimum criterion under the Steady State Seepage condition (Section 4.4.1). Remedial options considered for analysis consisted of:

- Flattening the riverside slopes,
- Installing structural reinforcement elements (piles, piers, tieback anchors) through the embankments,
- In-situ deep soil stabilization (deep soil mixing or jet grouting to create a cement stabilized zone through the embankments),
- Placing an additional thickness of riprap on the existing slopes,
- Removal and replacement of a portion of the riverside slopes with a higher strength material (cement stabilized fill, or geogrid reinforced/mechanically stabilized fill)

A discussion of the merits and affects of the various remedial measures that were considered is presented in Section 4.4.2 as well as the rationale for the recommended remedial measure chosen. Graphical results of the global stability and seepage analyses for all cross sections and design cases are presented in Appendix D of this report.

4.4.1 Existing Embankments Under Steady State Seepage Conditions

Global stability and seepage analysis results for each cross section of the existing embankment under steady state seepage conditions are presented in Appendix D (Exhibits D-2 to D-11). Table 4 presents a summary of the minimum factors of safety for the critical slip surfaces evaluated. All sections were found to have factors of safety less than the minimum required factor of safety of 1.4 for this design condition.

Table 4. Existing Embankment Under Conditions of Steady State Seepage

	Estimated Factor of Safety Obtained from Analysis	
	Steady State Seepage Design Condition	
Section[1]	Required Minimum Factor of Safety[2]	Riverside Slope
A	1.4	1.30
B	1.4	1.25
C	1.4	1.26
D	1.4	1.32
E	1.4	1.26

1. Refer to Ash Pond Plan in Exhibit D-1, for cross section location.
2. Reference: Table 6.1b (EM 1110-2-1913)

4.4.2 Stabilized Embankment Slopes Under Steady State Seepage Conditions

The analyses of existing embankment slopes indicated the critical zone of the embankment with lower factors of safety lay primarily within the slopes on the riverside of the crest. Options considered to increase the factor of safety included regrading (flattening) the slopes, installing structural reinforcing elements (piers, piles or tieback anchors), in-situ deep soil stabilization (deep soil mixing or jet grouting to create a high strength, cemented stabilized zone in the embankment), placing additional riprap on the existing slopes, and removal and replacement of a portion of the riverside slopes with a higher strength material (cement stabilized fill, or geogrid reinforced/mechanically stabilized fill).

Flattening the riverside levee slopes provided limited increases in stability (factor of safety of approximately 1.3 for a 2.5:1 slope) without significant relocation of the levee sections toward the landside, which would require substantial excavation of ash pond materials to construct the flattened sections. Deep structural reinforcement and deep in-situ stabilization techniques would be constructed through the crest of the embankment and are difficult to install on the embankment side slopes and did not provide sufficient increased stability in the near surface river bank zone. These techniques are most suited to reinforce against deep-seated instability and are not suited to relatively shallow reinforcement such as was required for these embankment slopes. Adding up to 5 feet of additional riprap to the existing slopes was found to provide limited increase in factor of safety as this primarily affected the very near surface of the slopes and did not significantly affect the zone of lower stability within the slope. Following consideration of the above options, removal and replacement of a portion of the river side slopes with a higher strength material (cement stabilized fill or geogrid-reinforced, mechanically stabilized fill) was chosen for our analysis.

A parametric analysis of the effect of various removal and replacement geometries on the factor of safety indicated that a 10-foot wide stabilized zone on the riverside slope (in addition to the rip rap erosion control layer) with a 15-foot wide by 8-foot deep stabilized crest cap should provide an adequate increase in stability. Seepage analysis of the cement stabilized option indicated that the lower permeability of the stabilized zone would require inclusion of a free-draining chimney drain between the stabilized zone and the existing embankment materials to control seepage and prevent excess pore pressure problems in the embankment for this option. Seepage analysis of the geogrid-reinforced, mechanically stabilized fill option indicated a chimney drain would not be required for this option. Typical cross section showing the two (2) recommended stabilized face geometry remedial options are shown in Exhibits D-1A and D-1B. Graphical results of the seepage and stability analyses under conditions of steady state seepage are presented in Exhibits D-12 to D 21 and are summarized in Table 5. These recommended remedial options provide factors of safety greater than the minimum required factor of safety of 1.4 for the Steady State Seepage design condition.

Table 5. Stabilized Embankment Slopes Under Conditions of Steady State Seepage

Section[1]	Estimated Factor of Safety Obtained from Analysis	
	Steady State Seepage – Stabilized Slope	
	Required Minimum Factor of Safety[2]	Riverside Slope
A	1.4	1.44
B	1.4	1.45
C	1.4	1.42
D	1.4	1.51
E	1.4	1.42

1. Refer to Ash Pond Plan in Exhibit D-1, for cross section location.
2. Reference: Table 6.1b (EM 1110-2-1913)

4.4.3 Stabilized Embankment Slopes Under Sudden Drawdown Conditions

In addition to the requirement for the Steady State Seepage design condition, the stabilized slope face remedial cross sections were analyzed under Sudden Drawdown conditions, which require a minimum factor of safety of 1.2. Graphical results of the stability analyses for the stabilized embankment slopes under sudden drawdown conditions are presented in Exhibits D-22 to D-26 and are summarized in Table 6. These recommended remedial options provide factors of safety greater than the minimum required factor of safety of 1.2 for the Sudden Drawdown design condition.

Table 6. Stabilized Embankment Slopes Under Conditions of Sudden Drawdown

	Estimated Factor of Safety Obtained from Analysis	
	Sudden Drawdown Conditions – Stabilized Slope	
Section[1]	Required Minimum Factor of Safety[2]	Riverside Slope
A	1.2	1.23
B	1.2	1.26
C	1.2	1.25
D	1.2	1.26
E	1.2	1.25

1. Refer to Ash Pond Plan in Exhibit D-1, for cross section location.
2. Reference: Table 6.1b (EM 1110-2-1913)

4.4.4 Temporary Excavation for Stabilized Embankment Slope Construction

To assess the impact of temporary excavation during construction of the riverside slopes on the stability of the remaining embankments during construction, seepage and stability analyses were conducted to establish dewatering and excavation criteria for the remediation. Graphical results of the seepage and stability analyses are presented in Exhibits D-27 to D-30.

Dewatering will be required to control seepage through the embankment (from the ash pond to the river) to provide adequate stability during excavation and construction of the stabilized slope face. As shown in Exhibits D-27 to D-28, excavation for the stabilized slope replacement without adequate dewatering to lower the phreatic surface below the level of the excavation results in a factor of safety of only 1.02 due to the seepage pressures at the toe of the excavated slope and would present a high risk of failure during construction.

However, analysis of the required drawdown from a line of dewatering wells located along the landside crest of the embankment indicates a target drawdown to approximately elevation 565 feet will be required to reduce seepage pressures at the toe of the temporary excavation. The resulting global stability factor of safety for the dewatered excavation condition is estimated as approximately 1.4 (Exhibits D-29 to D-30), which is satisfactory for the temporary duration of the excavation.

4.4.5 Risk Assessment of Delaying Construction

Dewatering, excavation and reconstruction of the embankment slopes will require favorable weather and river stage conditions. Construction of a soil-cement stabilized fill would require temperatures above 40 degrees Fahrenheit to facilitate cement hydration and allow fill placement. Freezing temperatures during cement stabilization retard cement hydration, reduce strength gain and can disrupt and destroy cement bonding in the compacted material. Likewise, freezing temperatures can prevent proper placement and compaction of structural fill unless free-draining gravel is imported to replace the existing fill materials. Freezing temperatures also hamper dewatering efforts, increasing the risk of frozen pipes and blockages that could result in uncontrolled seepage during excavation and construction that would present a high risk of failure during construction.

In our opinion, construction should not commence until at least the Spring of 2011 when temperatures are high enough to allow construction of the stabilized slope face. In addition, construction will have to be coordinated with Mississippi River operating pool levels between Lock and Dams 14 and 15 to allow excavation to approximately elevation 563 - 565 feet. This will likely provide a narrow time window during the summer to complete construction.

Terracon was asked to provide a preliminary risk assessment of delaying construction relative to the potential for a progressive failure that could breach the existing levee embankments. It should be noted that our evaluation of the existing embankments under steady state seepage conditions indicate the existing factor of safety is greater than 1.2. Further, MEC has reported that the existing embankments have not exhibited signs of instability since the 2001 regrading and riprap erosion control construction. In our opinion, these factors would indicate the existing embankment would remain stable for the short term under river level and flooding conditions similar to those experienced since 2001.

To approximate a potential worst case scenario of this kind, we modeled a semi-circular zone of riverside embankment slope approximately 20 feet wide, extending from the toe of the slope upward approximately 2/3 of the slope height, that rotated downward leaving a 10 to 12 foot tall head scarp in the slope. Analysis of the resulting geometry indicated that the remaining, unsupported scarp would also fail as a secondary slide and that progressive failures could encroach on the crest of the levee embankment.

To assess potential emergency remedial measures that could be taken in the event such a failure occurred, we analyzed the above described initial failure geometry and assigned a 15 to 25 percent reduction of frictional strength to the failed materials. The resulting loss of slope material was modeled as though the material could be rapidly replaced with dumped rip rap. Under this scenario, the resulting global factor of safety under steady state seepage conditions with Mississippi River levels at operating pool level were approximately 1.1. This factor of safety is lower than that estimated for the existing embankments under similar seepage conditions, but does indicate that a rapid response, emergency action plan such as this could be an appropriate measure to implement. A quantity of riprap could be stockpiled on-site to provide for this contingency and later used for construction of the remedial measures if not required for an emergency response. Stockpiles should not be allowed on the embankment.

5.0 DESIGN AND CONSTRUCTION RECOMMENDATIONS

As discussed in Section 4.4.5, in our opinion, construction of remedial measures should not commence until weather conditions and river levels are favorable. In the interim, MEC should be prepared to immediately implement emergency action consisting of riprap replacement if any slope instability is observed. This plan should include weekly visual inspection of the levee embankment slopes for signs of movement or distress. MEC should also make necessary arrangements with local quarries to ensure that adequate quantities of riprap are immediately available upon request or provide a stockpiled quantity on site.

As presented in Section 4.4.2, we recommend remedial stabilization of the existing embankment riverside slopes be undertaken as soon as possible during the Spring-Summer of 2011 to increase the global stability factor of safety to acceptable levels. We have developed two (2) options for the recommended remedial slope stabilization: 1) a cement-stabilized engineered fill section with a chimney drain shown in Exhibit D-1A and 2) a geogrid reinforced, mechanically stabilized fill section shown in Exhibit D-1B. Both sections require similar excavation quantities and provision of temporary dewatering during excavation and construction. Based on economic analysis of the two (2) options by HGM Associates, the geogrid-reinforced, mechanically stabilized section has a lower construction cost than the cement-stabilized option. In our opinion, the geogrid reinforced, mechanically stabilized section could also be constructed faster than the cement-stabilized fill section. Both remediation options require the replacement of the existing slope erosion control armor (riprap) following completion of the stabilization measures. The following provides additional discussion and specification requirements for both of the remedial stabilization construction options.

To reduce the potential for slope instability problems during temporary excavation and construction of the stabilized slope face, we recommend that the plans and specifications for the project require the contractor to construct the stabilized slope face in a sequenced manner such that no more than 300 lineal feet of slope is excavated at any one time. Excavation in a limited extent should enhance the stability of the cut slope by mobilizing soil shear strength in 3 dimensions versus a 2-dimentional, plane strain condition. The excavation and backfill work at each section should be performed on a round-the-clock basis until the excavation backfill reaches the designated elevation, set around original ground elevation prior to excavation. Based on the site layout and anticipated access constraints, we have anticipated that only one section will be excavated at a time, but that the excavation and reconstruction may occur as a rolling pattern. The specifications should require the contractor to submit a detailed excavation and construction sequencing plan for review prior to construction.

We recommend MEC or the contractor install inclinometers along the landward crest of the levee embankments to allow monitoring of potential slope movements during construction. Inclinometers should be set at approximately 300 foot intervals. Daily monitoring of the inclinometers should be conducted during excavation and backfilling to verify that construction activities are not adversely affecting the stability of the embankments.

Dewatering will be required to reduce the phreatic water surface below the base of all planned excavations and control seepage that would reduce the stability of the excavated slopes. In our analyses, we modeled a line of small diameter, closely spaced well points located along the landside of the existing crest to control seepage from the pond toward the excavation. Our analysis indicated that a drawdown to a target elevation of 565 feet should be sufficient to control the phreatic water surface during excavation. The contractor should submit a detailed dewatering and groundwater monitoring plan for review. Careful attention should be paid to adequate filter design in the dewatering wells to reduce the potential for removing fines from the embankment that could create voids or zones of lower density and induce piping failure. The contractor's submittal should include details of well design, installation, pump capacity and in-situ monitoring of drawdown levels.

Our evaluation of the estimated permeability of the existing embankment materials indicated a potential range of permeability on the order of $1(10)^{-3}$ cm/sec to $1(10)^{-5}$ cm/sec based on the textural classification of the materials and on evaluation of the pore water pressure dissipation tests performed in the CPT soundings. Based on these estimates, required pumping rates could vary over 2 orders of magnitude depending on the actual field permeability of the embankment materials. The dewatering contractor should be required to perform field pumping tests prior to excavation to determine the field permeability of the existing embankment materials and verify the effectiveness and capacity of the proposed dewatering plan.

The plans and specifications should also require the contractor to submit a plan detailing their proposed plan for Mississippi River level monitoring and forecasting in coordination with USACE operations. The plan should include details regarding early warning of anticipated river fluctuations and plans for emergency backfilling of existing excavations should forecast river levels exceed the elevation of the base of the proposed excavation. The emergency action plan should also include provisions for maintaining a sufficient quantity of excavated material or riprap in close proximity to the work and sufficient equipment to rapidly backfill all excavations within 24 hours before river levels are forecast to rise above the base of the excavation. Stockpiling materials on the existing levee section should not be allowed.

The typical section for the cement-stabilized engineered fill option including the chimney drain and riprap erosion control layer is shown in Exhibit D-1A. The chimney and base drainage layer to be constructed as part of the stabilized face should consist of free draining, crushed stone having a maximum particle size of 1-1/2 inches and no more than 5% passing the No. 200 sieve. The layer should be at least 1-foot thick and be encapsulated on each side of the crushed rock layer in a non-woven, needle-punched filter fabric similar to Contech C-60NW.

The mix design for the cement-stabilized material will require consideration of both strength and freeze-thaw durability to satisfy the strength parameters used in the stability analyses and provide long term durability of the stabilized zone. A laboratory mix design meeting these requirements can take 3 to 5 months to complete due to the sample curing time required and the length of time required to complete the required freeze and thaw cycling. The research performed by Bergeson et al. (1992) indicates that an addition rate of approximately 8 to 10 percent Portland cement was capable of producing sufficient strength when blended with the existing ash materials. The research did not specifically address freeze-thaw durability. If this option is chosen, MEC should initiate a mix design study as soon as possible so that specifications for the stabilized material can be prepared prior to construction. Terracon is available to provide these services.

Cement stabilized fill should be blended and compacted in 9-inch thick lifts within 2 hours of initial blending. The lifts should be compacted to at least 95 percent of the material's maximum dry density obtained from standard Proctor compaction tests (ASTM D698) at a moisture content within the range established by the laboratory mix design. Density and moisture content testing should be performed on each lift of the stabilized fill at a rate not less than 1 test per 2000 square feet of fill.

The typical section for the geogrid-reinforced, mechanically stabilized engineered fill option including the riprap erosion control layer is shown in Exhibit D-1B. The layers of geogrid should be placed at 2 foot vertical spacing, beginning with the base layer at approximately elevation 564 feet. The lowest 4 layers (elevations 564 to 570 feet) should be a minimum of 10 feet long. From elevation 572 feet to the crest, 4 layers of geogrid, having a minimum length of 15 feet should be used. The top layer should be placed at an elevation that will allow placement of at least 18 inches of material above the top layer. Due to the variable elevation of the levee embankment crest, this may require adjustment of the vertical spacing in the upper layers of geogrid reinforcement.

All geogrid reinforcement should consist of Tensar UX1700 uniaxial geogrid. Geogrid layers should be placed with the strong axis perpendicular to the centerline of the levee embankment. All geogrid layers should be manually tensioned and staked prior to spreading, placement and compaction of engineered fill on top of the layer. The manufacturer's specifications for storing, handling, placing and compacting reinforcement and reinforced fill should be followed. Engineered fill within the reinforced zone should be compacted in 6-inch lifts to at least 95 percent of the material's maximum dry density obtained from standard Proctor compaction tests at moisture contents within a range of 3 percent below to 3 percent above the optimum moisture content. Density and moisture content testing should be performed on each lift of the stabilized fill at a rate not less than 1 test per 2000 square feet of fill.

Following completion of the stabilized slope face section, the existing riprap erosion control layer should be reconstructed along the riverside slope face. This section should consist of a 6-inch thick sand-gravel bedding layer and a 1.5-foot minimum thickness of 18-inch nominal sized riprap. Layer thicknesses are to be measured normal to the layer orientation.

6.0 GENERAL COMMENTS

The global stability analyses presented in this draft report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. The models for global stability analysis were developed using limited, available design drawings and survey data provided by others. Subsurface stratigraphy for each model was extrapolated from nearby borings; actual conditions may be different and such differences would affect the results of our analyses. This draft report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident without further exploration.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This draft report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that the actual embankment conditions are found to vary from the analyses models described in this report, the analyses and opinions expressed herein shall not be considered valid unless Terracon reviews the actual conditions and further verifies the analyses and opinions of this draft report in writing.

PROFESSIONAL ENGINEER LICENSED VAUGHN RUPNOW 19259 IOWA	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. Vaughn Rupnow 12/7/2010 Vaughn Rupnow, P.E. Date My license renewal date is December 31, 2010.

APPENDIX A

FIELD EXPLORATION

N

LEGEND

⊕ APPROXIMATE BORING LOCATION

THIS DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

NOT TO SCALE

Project Mngr: WKB	Project No. 07105081	Terracon Consulting Engineers and Scientists	BORING LOCATION SKETCH	EXHIBIT
Drawn By: DWD	Scale: AS SHOWN		SOUTH ASH CONTAINMENT POND RIVERSIDE GENERATING STATION BETTENDORF, IOWA	A-1
Checked By: WKB/MRF	File No. GEO07105081-1			
Approved By: WKB	Date: NOV. 2010	870 40th Avenue Bettendorf, Iowa 52722 (563) 355-0702 (563) 355-4789		

BORING NO. 4

CLIENT
HGM Associates, Inc.

SITE **Riverside Generating Station**
Bettendorf, Iowa

PROJECT
Ash Containment Ponds - South Pond

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 578 ft	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	TESTS: WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	ATTERBERG LIMITS
	FILL, SANDY LEAN CLAY Brown and Dark Brown				HS						
				1	ST	9		16	108	2700	
	Caving very loose sand layers, very soft from about 2 feet to 7 feet	5			HS						
	8 — 570										
	FILL, SILT, SAND, AND GRAVEL Dark Gray			2	SS	4	2	21			
	Fine to medium gravel with silt at Sample 2	10			HS						
	Silty sand and gravel at Sample 3 ∇			3	SS	14	3	41			
		15			HS						
	Sitly fine sand at Sample 4			4	SS	18	WOH	121			
		20			HS						
	Silty clay with sand at Sample 5			5	SS	18	6	30			
	26 — 552	25			HS						
	WEATHERED LIMESTONE*** Light Gray										
	28.5 — 549.5										
	BOTTOM OF BORING			6	SS		50/2"	10			

***Classification of rock materials has been estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

WOH = Sampler advanced the entire sampling interval under the weight of the hammer and rods alone.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Pocket Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 14	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED			9-29-10
BORING COMPLETED			9-29-10
RIG	550	FOREMAN	SS
APPROVED	VER	JOB #	07105081

BORING NO. 5

CLIENT
HGM Associates, Inc.

SITE **Riverside Generating Station**
Bettendorf, Iowa

PROJECT
Ash Containment Ponds - South Pond

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 580 ft	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	TESTS: WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	ATTERBERG LIMITS
	FILL, SANDY SILT, TRACE GRAVEL Dark Gray				HS						
				1	SS	18	3	30			
					HS						
				2	ST	20		42	77		
		5			HS						
				3	ST	22		26	89		
					HS						
				4	SS	16	4	20		*1500	
	Higher gravel content below about 6 feet	10			HS						
				5	SS	6	2	21			
		15			HS						
	Silty sand at Sample 6			6	SS	18	3	51			Non Plastic
		20			HS						
	Silty with sand at Sample 7			7	SS	18		50			LL=40 PI=4
		25			HS						
	27 — 553										
	WEATHERED LIMESTONE*** Light Gray			8	SS	15	50/0"	13			
	30 — 550										
	BOTTOM OF BORING										

***Classification of rock materials has been estimated by the drill crew from drilling characteristics. Core samples and petrographic analysis may reveal other rock types.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Pocket Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 18	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED	9-29-10
BORING COMPLETED	9-29-10
RIG 550	FOREMAN SS
APPROVED VER	JOB # 07105081

BORING NO. 6

CLIENT: **HGM Associates, Inc.**

SITE: **Riverside Generating Station, Bettendorf, Iowa**

PROJECT: **Ash Containment Ponds - South Pond**

Approx. Surface Elev.: 577 ft

DESCRIPTION	DEPTH, ft.	USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	ATTERBERG LIMITS
FILL, SANDY SILT, TRACE GRAVEL Dark Gray				HS						
			1	ST	11		65	50	660	
			2	ST	15		85	47	440	
	5			HS						
Silty sand at Sample 3			3	ST	11		94	44		Non Plastic
Higher clay content at Sample 4			4	ST	18		27	93	370	LL=36 PI=16
	10			HS						
			5	SS	16	2	39		*500	LL=33 PI=3
▽	15			HS						
Higher gravel content below about 18 feet			6	SS	18	7	31		*1000	
	20			HS						
Silt with sand at Sample 7			7	SS	6	2	36			LL=38 PI=12
26 — 551	25			HS						
WEATHERED LIMESTONE*** Light Gray										
30 — 547			8	SS			18			
BOTTOM OF BORING	30									

***Classification of rock materials has been estimated by the drill crew from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Pocket Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 16	WD ▼
WL	▼	▼
WL		

Terracon

BORING STARTED			9-29-10
BORING COMPLETED			9-29-10
RIG	550	FOREMAN	SS
APPROVED	VER	JOB #	07105081

BORING NO. 7

CLIENT
HGM Associates, Inc.

SITE **Riverside Generating Station**
Bettendorf, Iowa

PROJECT
Ash Containment Ponds - South Pond

Approx. Surface Elev.: 576 ft

Depth (ft)	Description	Elev. (ft)
0–10	**FILL, SILTY SAND WITH GRAVEL** Dark Gray High gravel content below about 4 feet	566
10–26.5	**FILL, SILT WITH SAND, TRACE GRAVEL** ▽ Dark Gray	549.5
26.5–30	**WEATHERED LIMESTONE***** Light Gray	546

BOTTOM OF BORING

***Classification of rock materials has been estimated by the drill crew from drilling characteristics. Core samples and petrographic analysis may reveal other rock types.

WOH = Sampler advanced the entire sampling interval under the weight of the hammer and rods alone.

USCS SYMBOL	NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf	ATTERBERG LIMITS
		HS						
	1	SS	8	27	32		*500	
		HS						
	2	SS	8	2	31			
		HS						
	3	ST	8		30			
		HS						
	4	SS	18	WOH	108			Non Plastic
		HS						
	5	SS	10	WOH	65			
		HS						
	6	SS	18	WOH	61			LL=44 PI=10
		HS						
	7	SS	18	2	60			LL=41 PI=4
		HS						
	8	SS	0	50/0"				

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Pocket Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 11	WD ▼
WL	▼	▼
WL		

BORING STARTED	9-29-10		
BORING COMPLETED	9-29-10		
RIG	550	FOREMAN	SS
APPROVED	VER	JOB #	07105081

BORING NO. 8

CLIENT
HGM Associates, Inc.

SITE **Riverside Generating Station**
Bettendorf, Iowa

PROJECT
Ash Containment Ponds - South Pond

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, in.	SAMPLES: SPT - N ** BLOWS / ft.	TESTS: WATER CONTENT, %	TESTS: DRY UNIT WT pcf	TESTS: UNCONFINED STRENGTH, psf
	FILL, SILT WITH SAND, TRACE GRAVEL Dark Gray				HS					
				1	SS	12	4	46		
					HS					
				2	SS	12	2	61		
		5		3	ST	16		65		
	▽				HS					
				4	ST	0				
		10		5	SS	18	8	63		
					HS					
				6	ST	0				
		15			HS					
				7	SS	22	WOH	59		
				8	SS	22	WOH	57		
		20			HS					
	Higher gravel content at Sample 9			9	ST	23		64		
					HS					
				10	SS	20	WOH	54		
		25			HS					
26.5										
27	**WEATHERED LIMESTONE*****									

BOTTOM OF BORING

Auger refusal at about 27 feet.

***Classification of rock materials has been estimated from drilling characteristics. Core samples and petrographic analysis may reveal other rock types.

WOH = Sampler advanced the entire sampling interval under the weight of the hammer and rods alone.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Pocket Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 8	WD	▼
WL	▼		▼
WL			

Terracon

BORING STARTED	11-3-10		
BORING COMPLETED	11-3-10		
RIG	35E	FOREMAN	SS
APPROVED	VER	JOB #	07105081

BORING NO. 9

CLIENT
HGM Associates, Inc.

SITE **Riverside Generating Station**
Bettendorf, Iowa

PROJECT
Ash Containment Ponds - South Pond

GRAPHIC LOG (depth)	DESCRIPTION
	FILL, SILTY CLAY WITH SAND AND GRAVEL Dark Gray Fat clay layers below about 6 feet
11	**FILL, SILT WITH SAND** ▽ Dark Gray Less sand at Sample 6
24.5	BOTTOM OF BORING (WEATHERED LIMESTONE)*** ***Classification of rock materials has been estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types. WOH = Sampler advanced the entire sampling interval under the weight of the hammer and rods alone.

DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, in.	SAMPLES: SPT - N ** BLOWS / ft.	TESTS: WATER CONTENT, %	TESTS: DRY UNIT WT pcf	TESTS: UNCONFINED STRENGTH, psf
			HS					
		1	SS	12	9	38		*2000
			HS					
		2	SS	11	7	14		*2000
5			HS					
		3	ST	8	4	21		*1500
			HS					
		4	ST	0				
10			HS					
		5	ST	6		50		
		6	SS	18	11	50		
			HS					
15		7	SS	18	3			
		8	ST	8		46		
		9	ST	4		45		
20		10	ST	12		54		
			HS					
		11	SS	13	WOH 50/2"	50		

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Pocket Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft		
WL	▽ 12	WD ▼
WL	▼	▼
WL		

Terracon

BORING STARTED			11-3-10
BORING COMPLETED			11-3-10
RIG	35E	FOREMAN	SS
APPROVED	VER	JOB #	07105081

BORING NO. 10

CLIENT
HGM Associates, Inc.

SITE **Riverside Generating Station**
Bettendorf, Iowa

PROJECT
Ash Containment Ponds - South Pond

Depth (ft)	Description	Number	Type	Recovery, in.	SPT - N ** Blows / ft.	Water Content, %	Dry Unit Wt pcf	Unconfined Strength, psf
0–8.5	**FILL, SAND AND CRUSHED LIMESTONE WITH CLAY** Dark Brown		HS					
		1	SS	8	9	8		
			HS					
		2	SS	8	8	12		
			HS					
		3	SS	5	11	4		
			HS					
8.5–15.5	**FILL, SANDY FAT CLAY WITH SILT LAYERS** Brown	4	SS	7	2	30		*500
			HS					
		5	ST	15		32	92	*500
15.5–26.5	**FILL, SILT WITH SAND, TRACE GRAVEL** Dark Brown	6	ST	12		23	102	
			HS					
		7	SS	22	21	53		
	∇		HS					
		8	SS	18	9	58		
26.5–27.2	**WEATHERED LIMESTONE***** Light Gray	9	SS	2	50/2"	14		

BOTTOM OF BORING

***Classification of rock materials has been estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Pocket Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft		
WL	∇ 20	WD ▼
WL	▼	▼
WL		

Terracon

BORING STARTED	11-3-10
BORING COMPLETED	11-3-10
RIG 35E	FOREMAN SS
APPROVED VER	JOB # 07105081

BORING NO. 11

CLIENT **HGM Associates, Inc.**	
SITE **Riverside Generating Station** **Bettendorf, Iowa**	PROJECT **Ash Containment Ponds - South Pond**

Description (graphic log)

- 0–24: **FILL, SANDY SILT, TRACE GRAVEL** — Dark Brown (water level symbol ∇ at approx. 14.5 ft)
- 24–25.5: **HIGHLY WEATHERED LIMESTONE***** — Gray

BOTTOM OF BORING

***Classification of rock materials has been estimated from disturbed samples. Core samples and petrographic analysis may reveal other rock types.

DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	TESTS: WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
			HS					
		1	SS	6	3	29		
			HS					
5		2	SS	10	2	35		
			HS					
		3	SS	12	5	30		
			HS					
10		4	SS	12	28	31		
			HS					
15		5	SS	14	3	36		
			HS					
20		6	SS	12	5	37		
			HS					
25		7	SS	16	43	15		

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Pocket Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 14.5	WD	▼
WL	▼		▼
WL			

Terracon

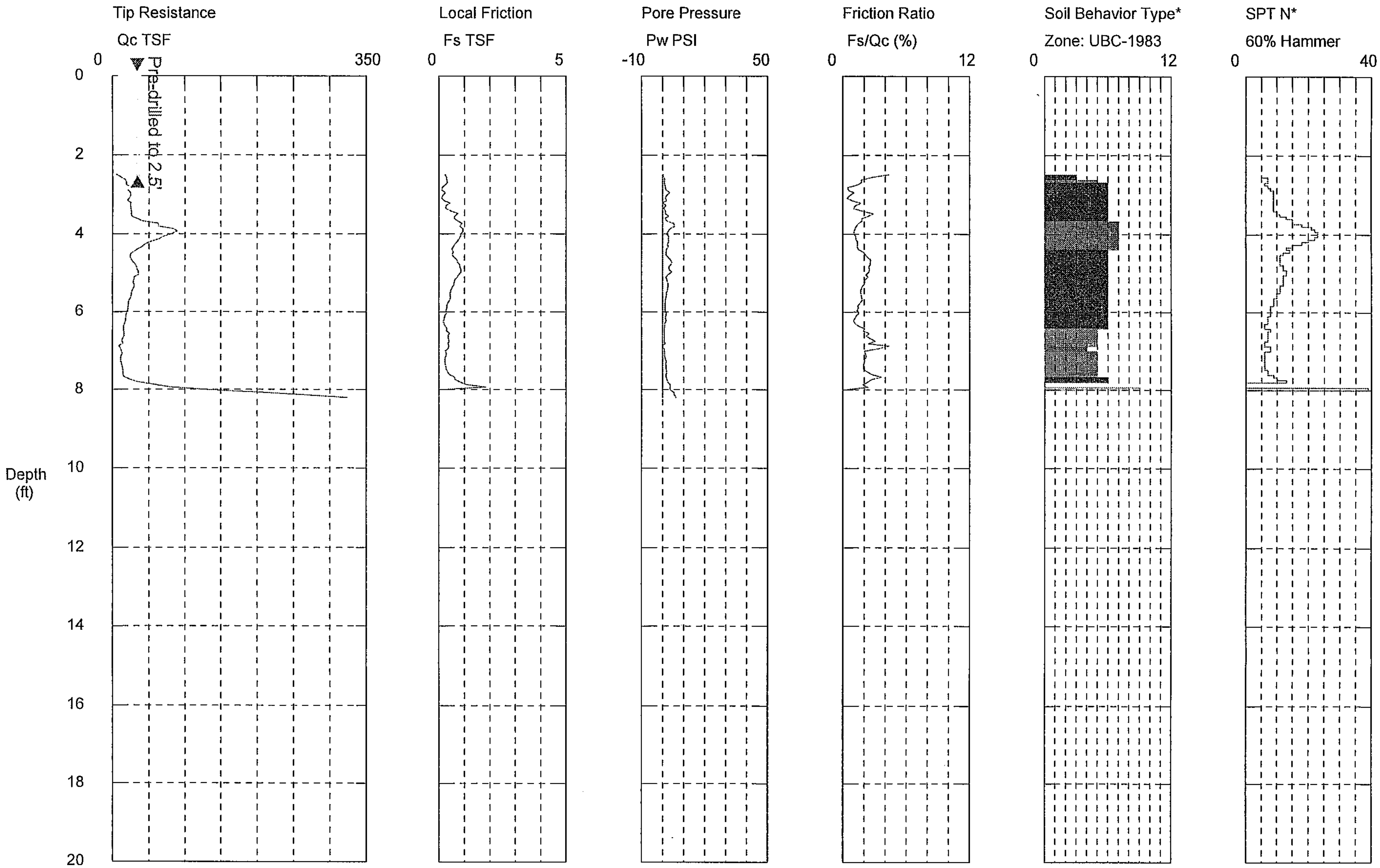
BORING STARTED			11-15-10
BORING COMPLETED			11-15-10
RIG	35E	FOREMAN	RP
APPROVED	VER	JOB #	07105081

BOREHOLE 99 BORING LOGS SOUTH POND.GPJ TERRACON.GDT 12/1/10

Terracon

Operator: GF Jr
Sounding: CPT-5a
Cone Used: DSG1119

CPT Date/Time: 10/20/2010 4:48:27 PM
Location: Ash Containment Pond
Job Number: 07105081



Maximum Depth = 8.20 feet

Depth Increment = 0.066 feet

1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Pre-Drill 2' 6"

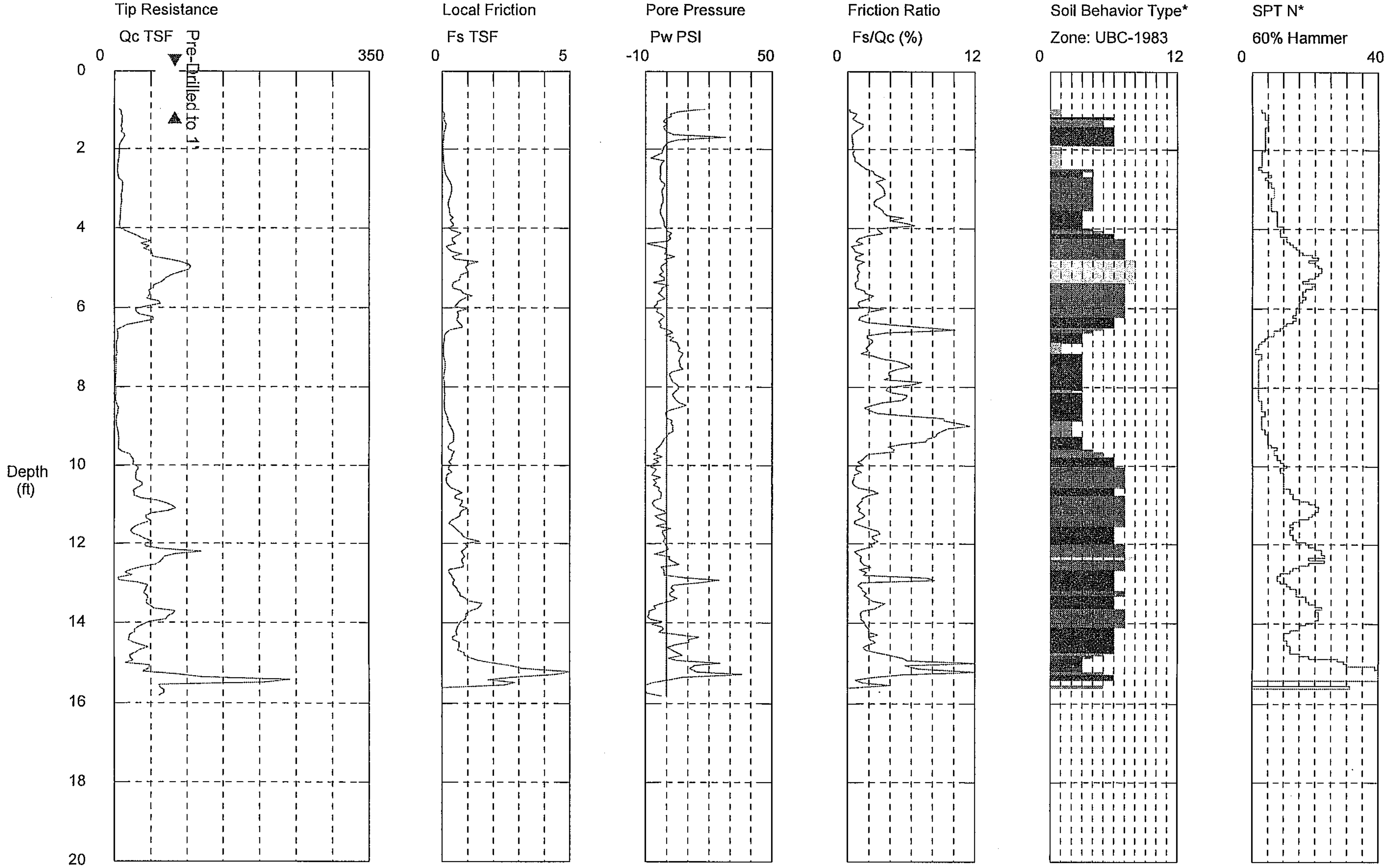
*Soil behavior type and SPT based on data from UBC-1983

Exhibit A-10

Terracon

Operator: GF Jr
Sounding: CPT-6
Cone Used: DSG1119

CPT Date/Time: 10/20/2010 3:13:23 PM
Location: Ash Containment Pond
Job Number: 07105081



Maximum Depth = 15.81 feet

Depth Increment = 0.066 feet

1 sensitive fine grained
2 organic material
3 clay
Pre-Drill 12"
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

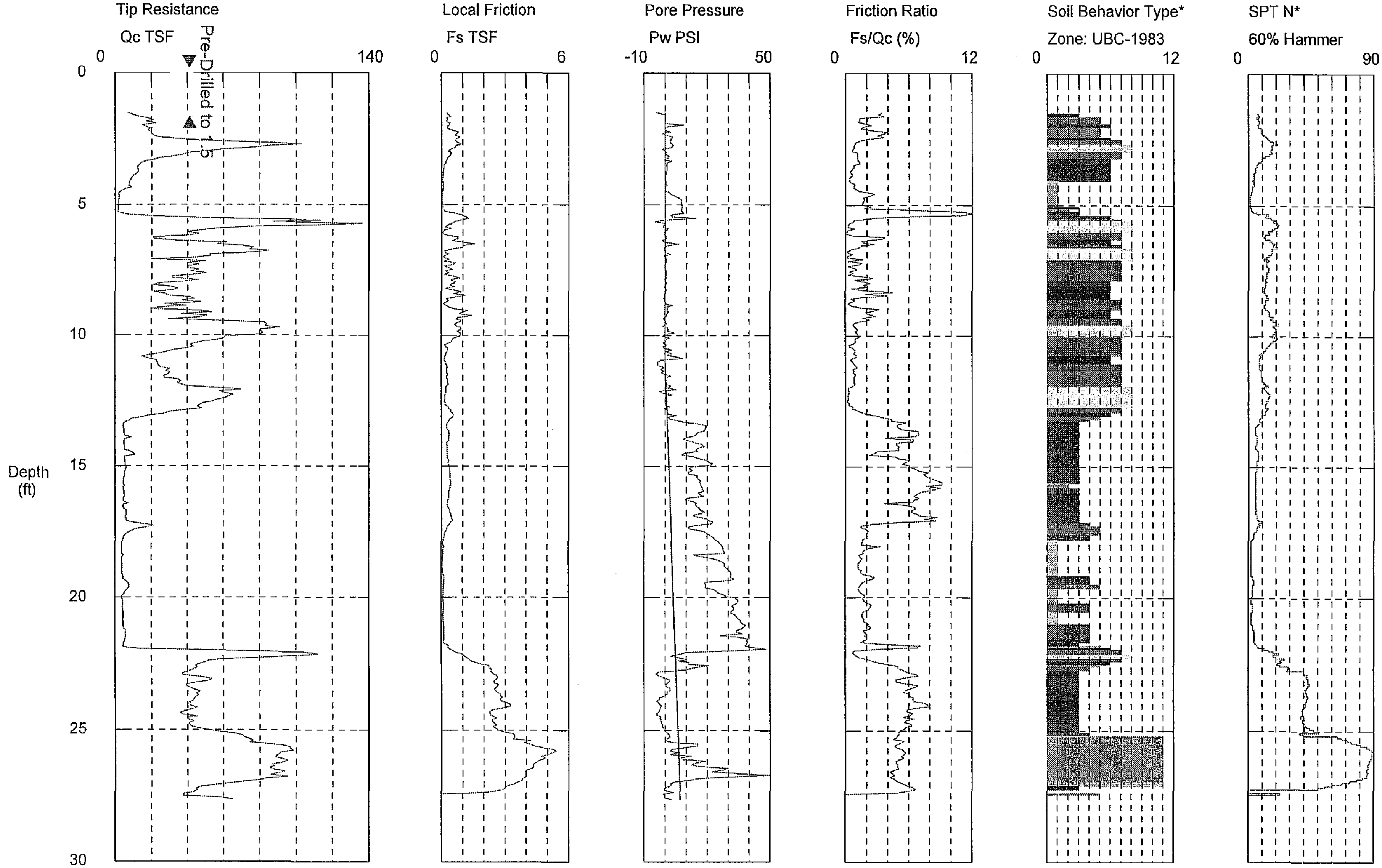
*Soil behavior type and SPT based on data from UBC-1983

Exhibit A-11

Terracon

Operator: GF Jr
Sounding: CPT-7b
Cone Used: DSG1119

CPT Date/Time: 10/20/2010 1:34:07 PM
Location: Ash Containment Pond
Job Number: 07105081



Maximum Depth = 27.62 feet

Depth Increment = 0.066 feet

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

Pre-Drill to 1.5'

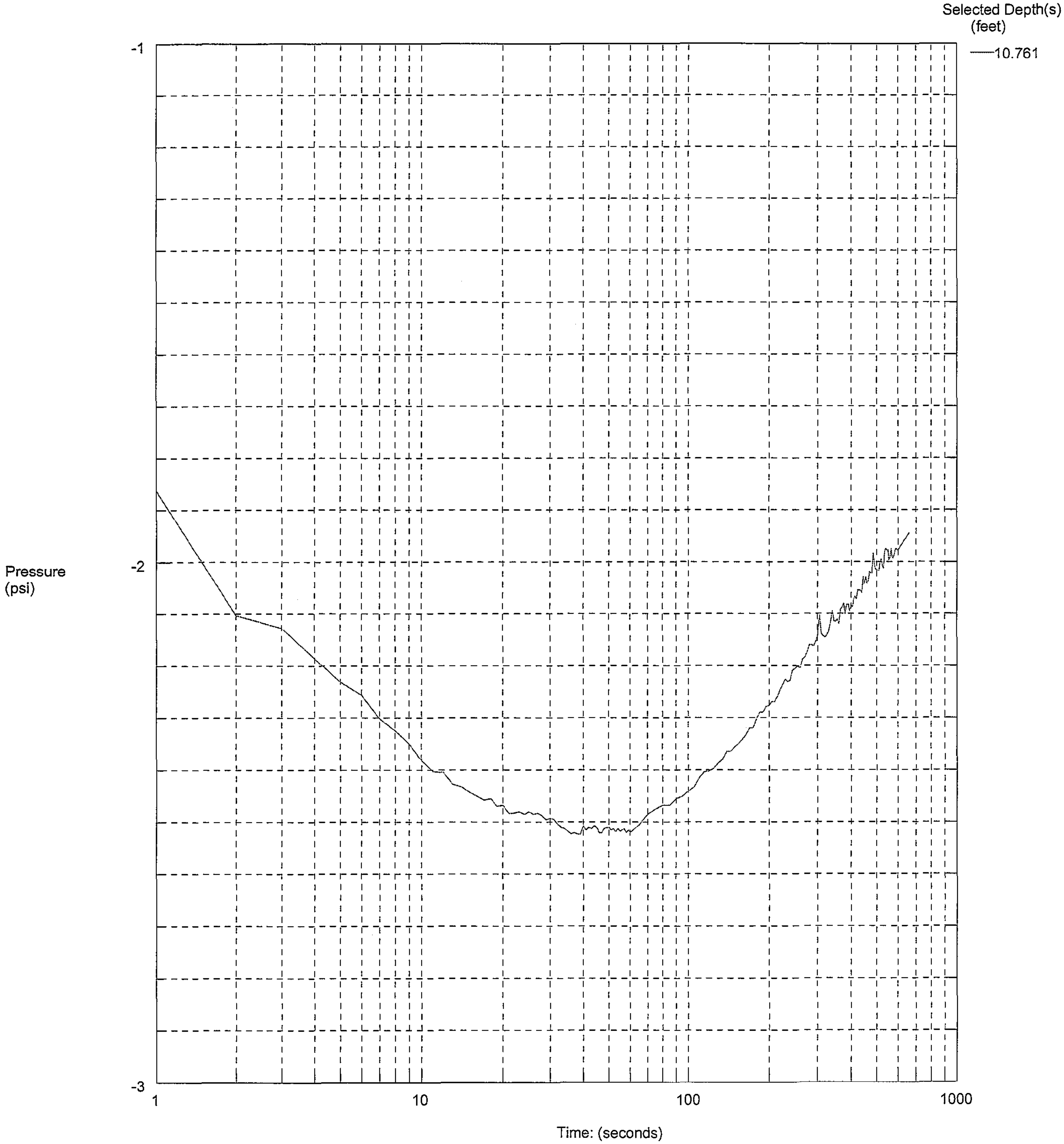
*Soil behavior type and SPT based on data from UBC-1983

Exhibit A-12

Terracon

Operator GF Jr
Sounding: CPT-6
Cone Used: DSG1119

CPT Date/Time: 10/20/2010 3:13:23 PM
Location: Ash Containment Pond
Job Number: 07105081



Maximum Pressure = -1.852 psi
Hydrostatic Pressure = 4.67 psi

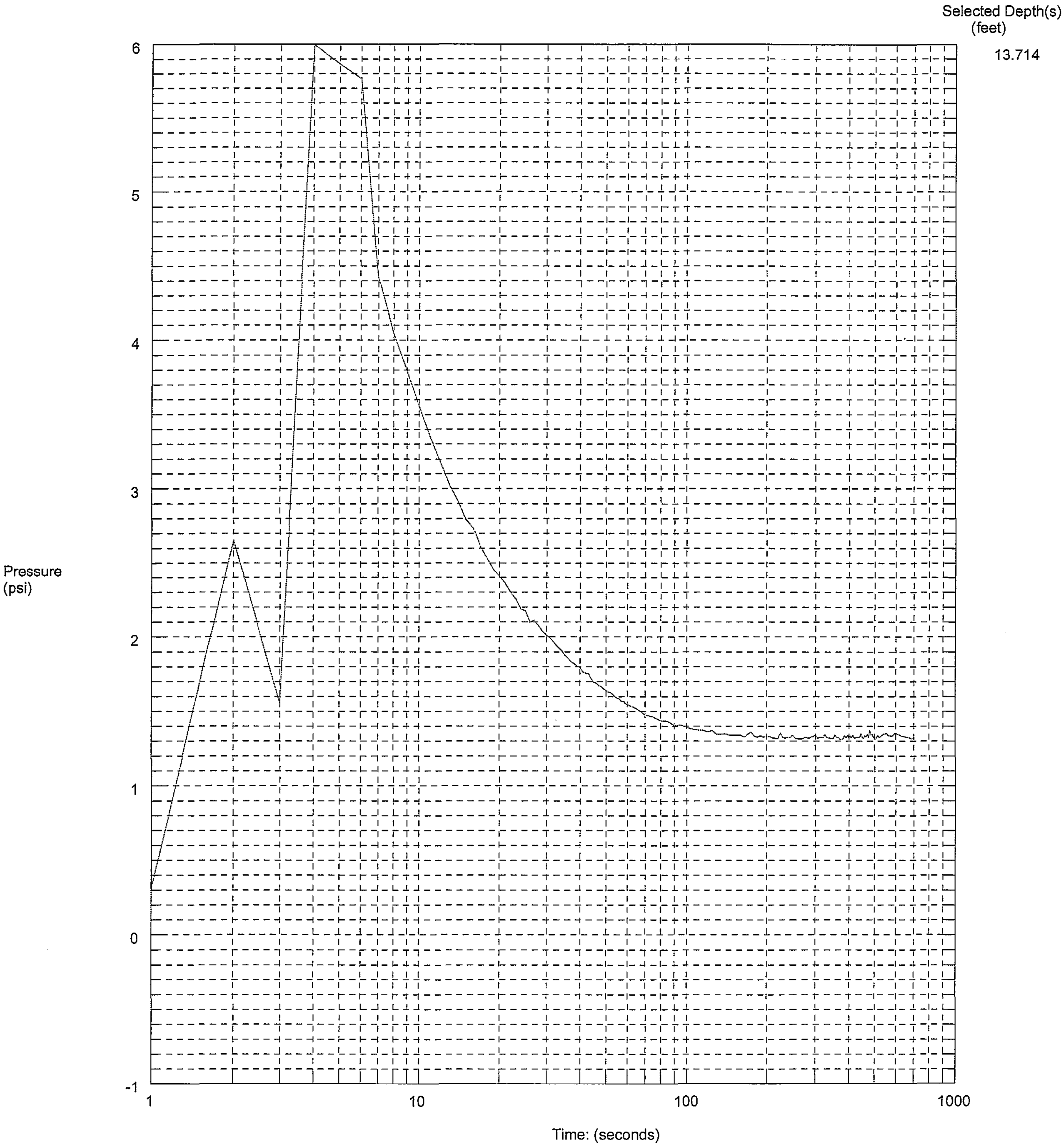
PLOTTED BY - jw
PLOTTED ON - 12/02/08

Exhibit A-13

Terracon

Operator GF Jr
Sounding: CPT-6
Cone Used: DSG1119

CPT Date/Time: 10/20/2010 3:13:23 PM
Location: Ash Containment Pond
Job Number: 07105081



Maximum Pressure = 5.996 psi
Hydrostatic Pressure = 5.952 psi

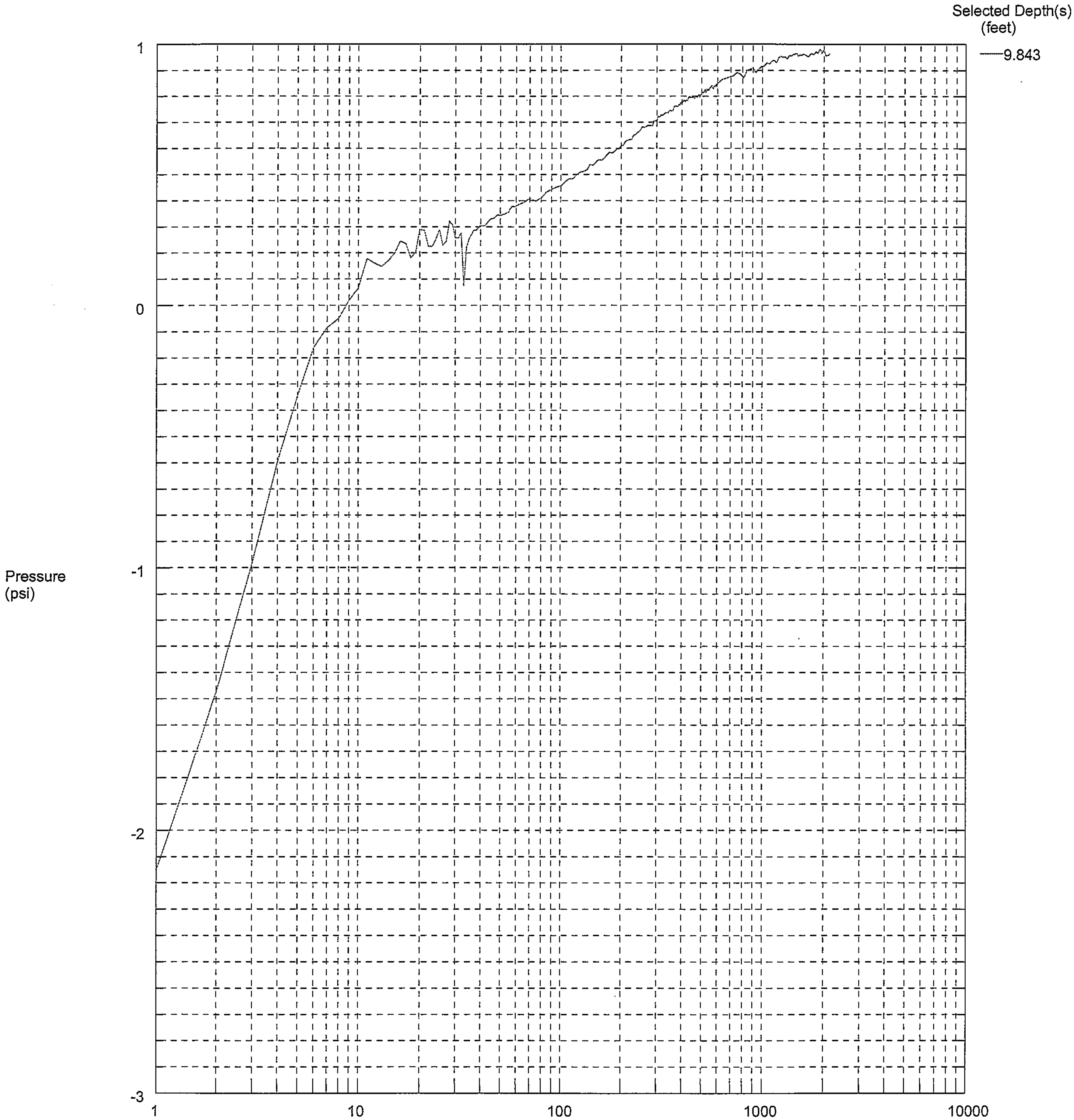
PLOTTED BY - jw
PLOTTED ON - 12/02/08

Exhibit A-14

Terracon

Operator GF Jr
Sounding: CPT-7b
Cone Used: DSG1119

CPT Date/Time: 10/20/2010 1:34:07 PM
Location: Ash Containment Pond
Job Number: 07105081



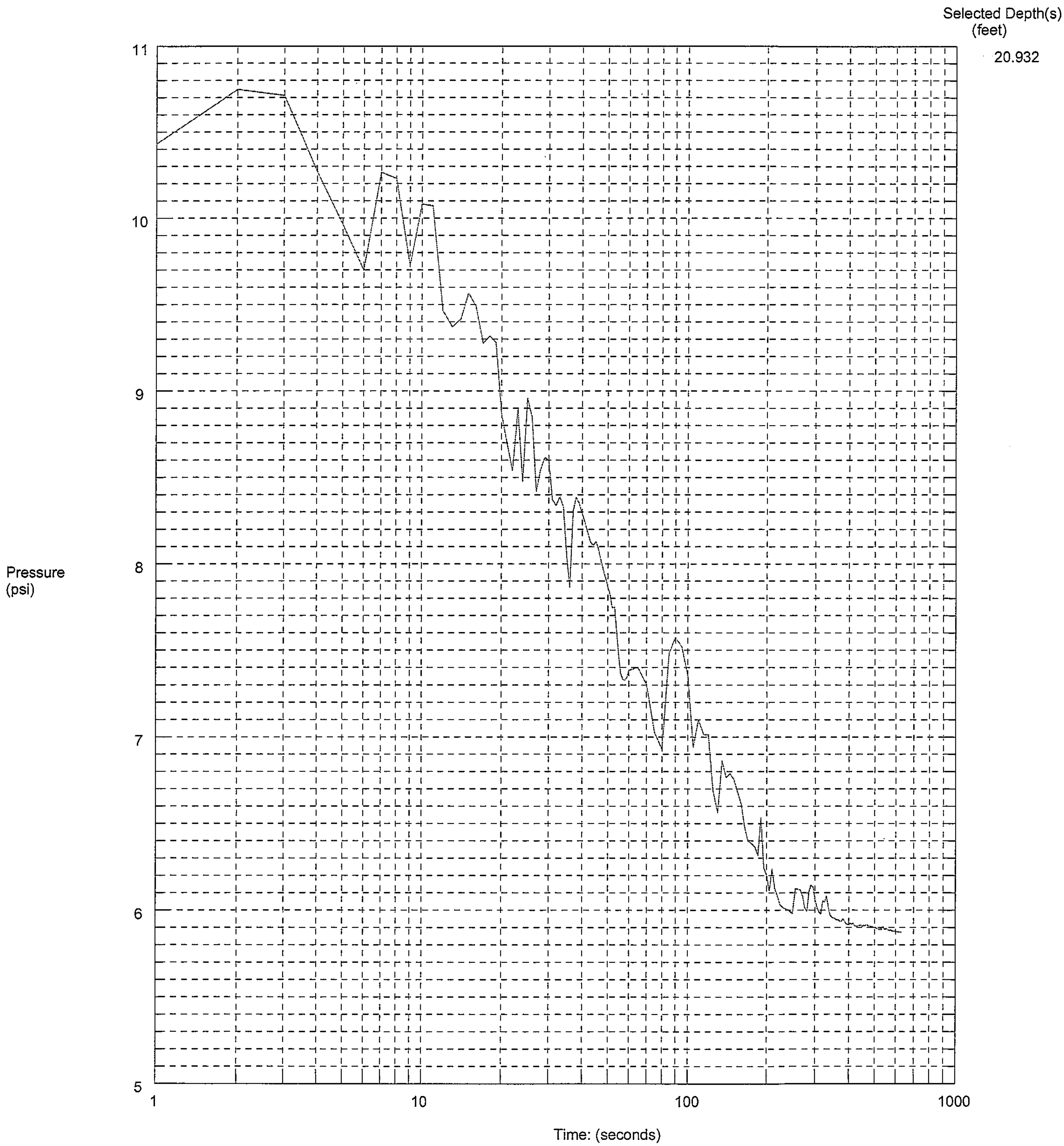
Maximum Pressure = 0.981 psi
Hydrostatic Pressure = 4.272 psi

PLOTTED BY - jw
PLOTTED ON - 12/02/08

Terracon

Operator GF Jr
Sounding: CPT-7b
Cone Used: DSG1119

CPT Date/Time: 10/20/2010 1:34:07 PM
Location: Ash Containment Pond
Job Number: 07105081

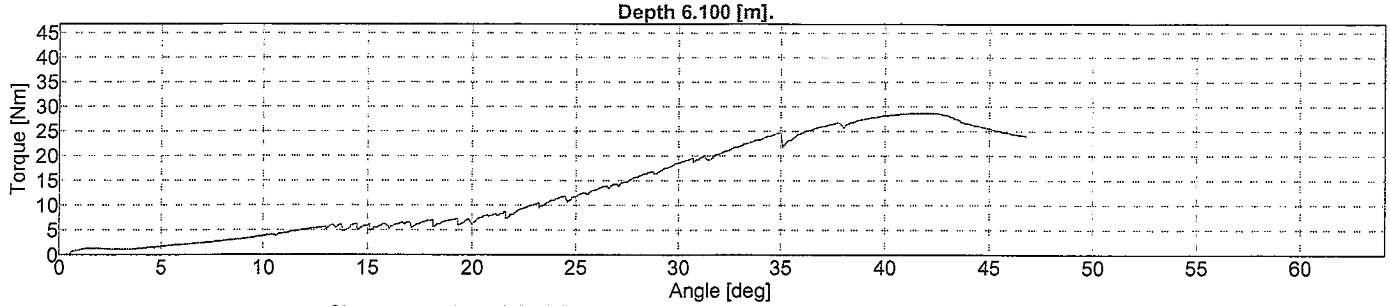


Maximum Pressure = 10.748 psi
Hydrostatic Pressure = 9.084 psi

PLOTTED BY - jw
PLOTTED ON - 12/02/08

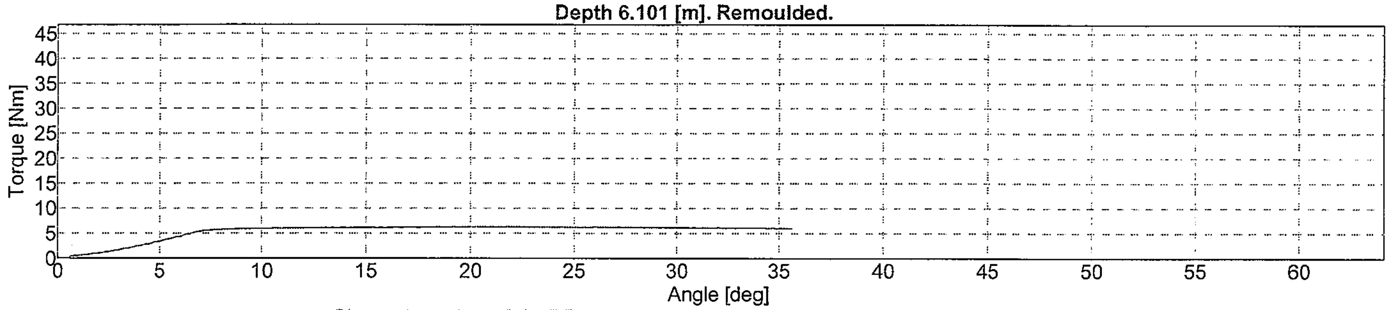
Exhibit A-16

Depth 6.100 [m].



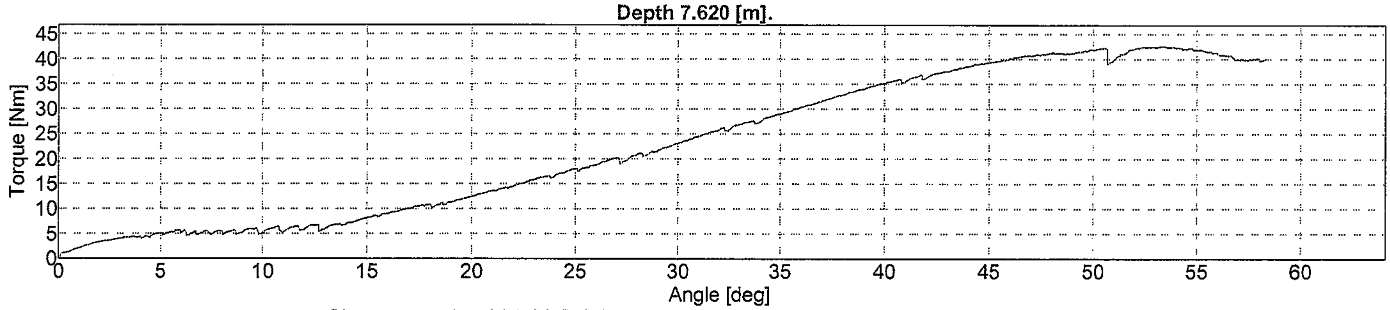
Shear strength = 50.86 [kPa], Max. torque = 28.72 [Nm], Rod friction = 5.60 [Nm]

Depth 6.101 [m]. Remoulded.



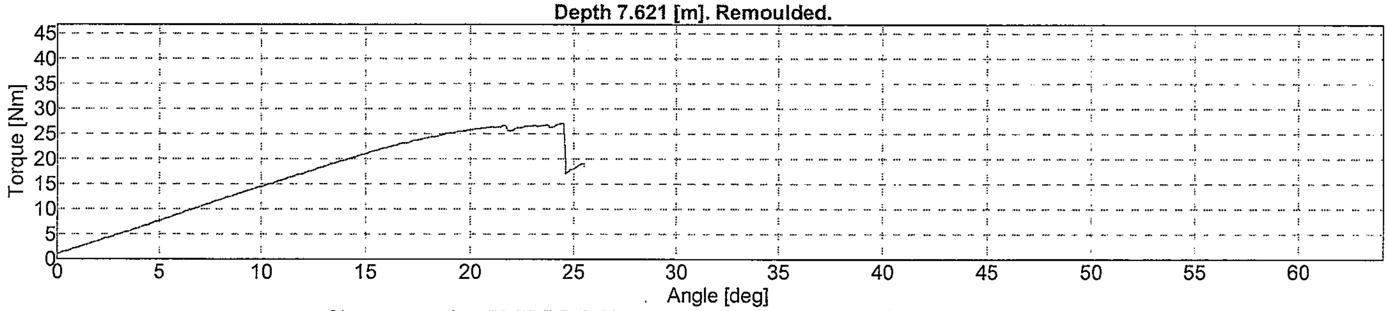
Shear strength = 12.94 [kPa], Max. torque = 6.32 [Nm], Rod friction = 0.44 [Nm]

Depth 7.620 [m].



Shear strength = 82.74 [kPa], Max. torque = 42.54 [Nm], Rod friction = 4.93 [Nm]

Depth 7.621 [m]. Remoulded.

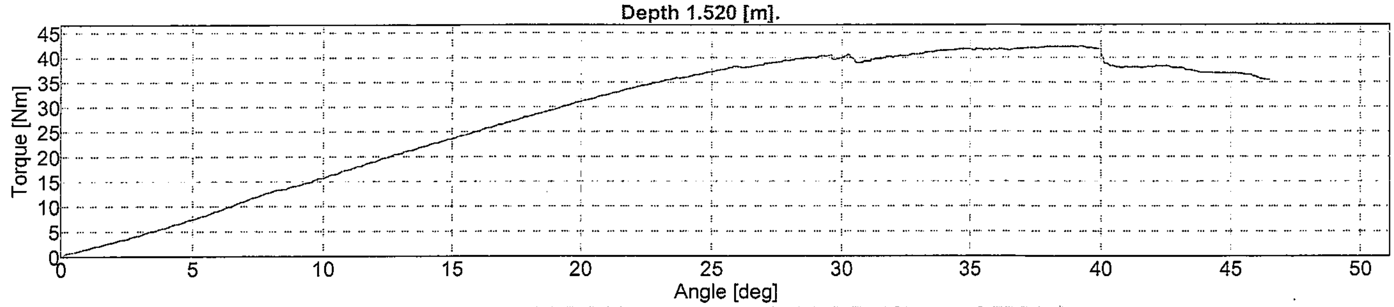


Shear strength = 56.52 [kPa], Max. torque = 27.02 [Nm], Rod friction = 1.33 [Nm]

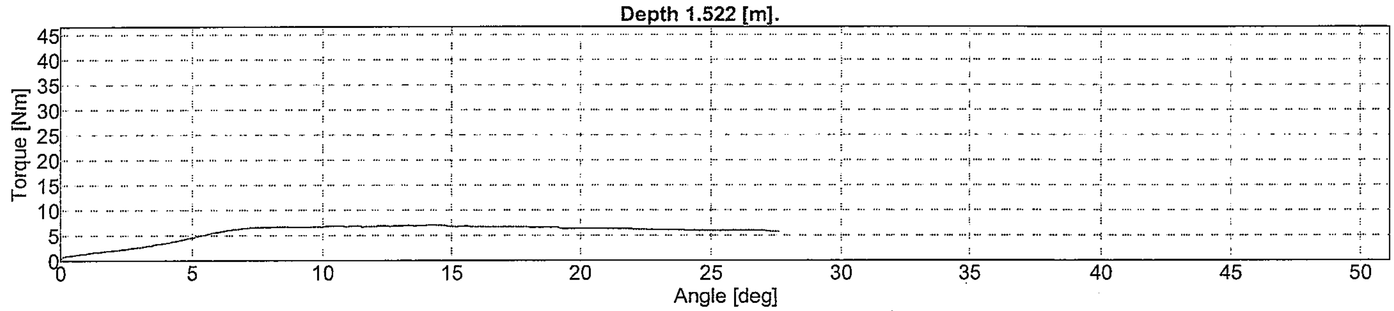
Terracon
Consulting Engineers & Scientists

Location	Position	Ground level	Test ID.
Riverside Generating Station	See Location Diagram	578	B-4
Project ID	**Client**	**Date**	**Scale**
07105081	HGM Associates, Inc	10/21/2010	1:100
Project		**Page**	**Fig.**
Ash Containment Pond Embankments		1/1	VST-1
Vane type & size		**File**	
Rectangular end, 10.0 x 5.0 cm		Iowa B-4.vct	

Exhibit A-17



Shear strength = 91.52 [kPa], Max. torque = 42.35 [Nm], Rod friction = 0.75 [Nm]

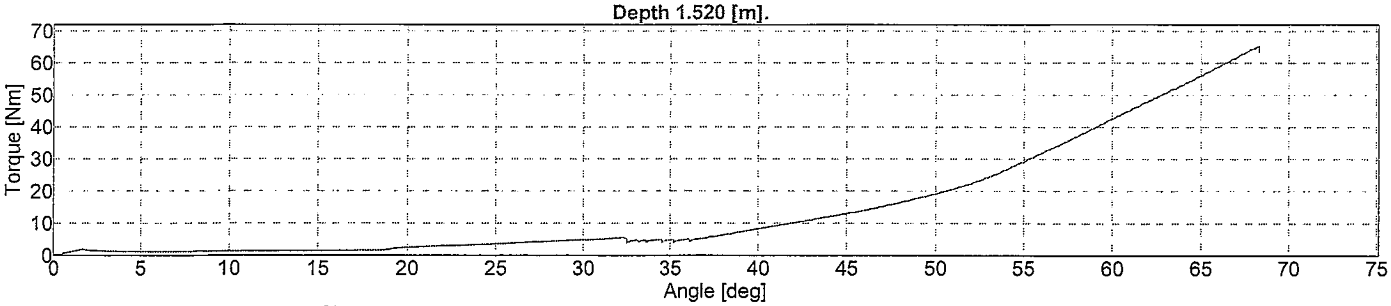


Shear strength = 13.53 [kPa], Max. torque = 7.07 [Nm], Rod friction = 0.92 [Nm]

Terracon
Consulting Engineers & Scientists

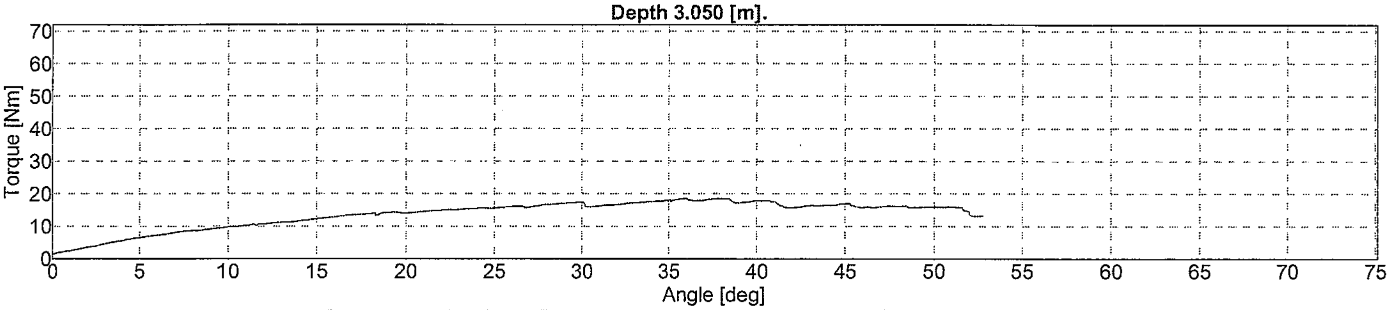
Location	Position	Ground level	Test ID.
Riverside Generating Station	See Location Diagram	580	B-5
Project ID: 07105081	Client: HGM Associates, Inc.	Date: 10/21/2010	Scale: 1:100
Project: Ash Containment Pond Embankments		Page: 1/1	Fig.: VST-2
Vane type & size: Rectangular end, 10.0 x 5.0 cm		File: Iowa B-5.vct	

Depth 1.520 [m].



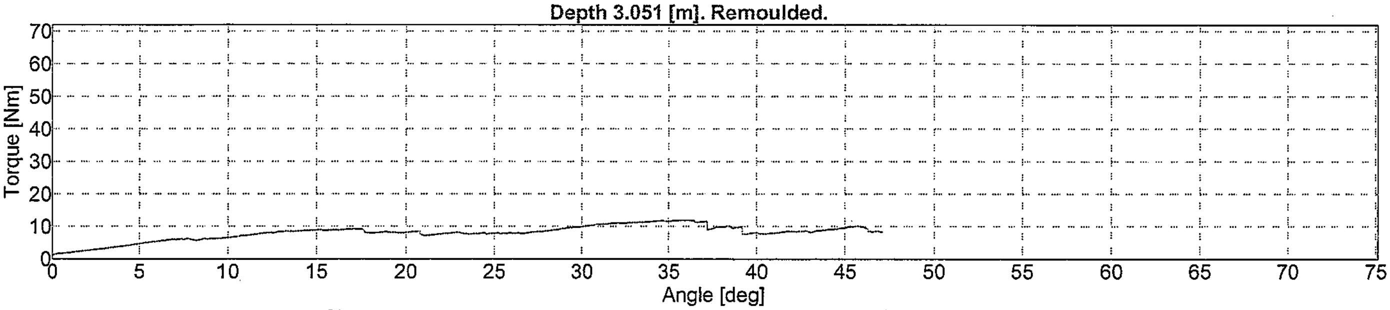
Shear strength = 140.65 [kPa], Max. torque = 65.42 [Nm], Rod friction = 1.49 [Nm]

Depth 3.050 [m].



Shear strength = 37.73 [kPa], Max. torque = 18.59 [Nm], Rod friction = 1.44 [Nm]

Depth 3.051 [m]. Remoulded.

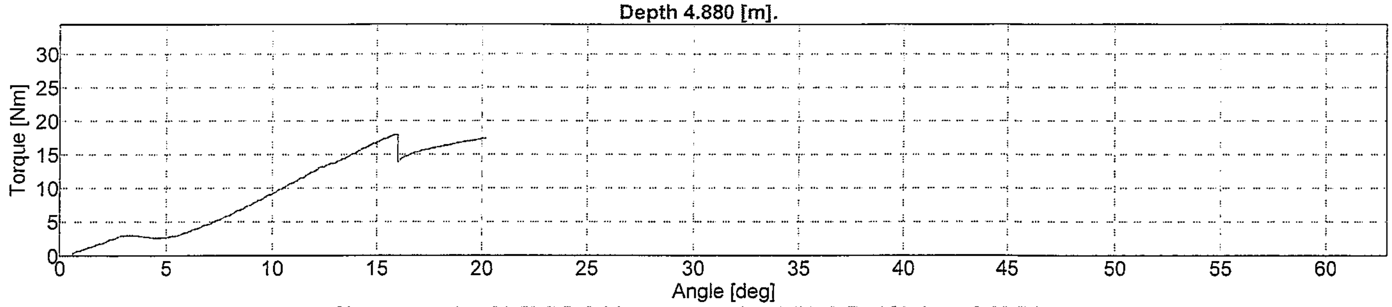


Shear strength = 23.43 [kPa], Max. torque = 11.98 [Nm], Rod friction = 1.33 [Nm]

Terracon
Consulting Engineers & Scientists

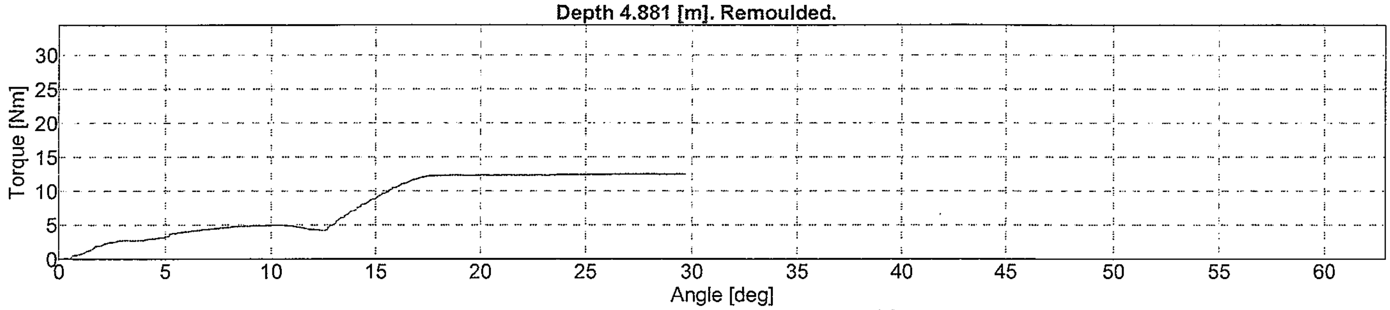
Location	Position	Ground level	Test ID.
Riverside Generating Station	See Location Diagram	577	B-6
Project ID	**Client**	**Date**	**Scale**
07105081	HGM Associates, Inc.	10/21/2010	1:100
Project		**Page**	**Fig.**
Ash Containment Pond Embankments		1/1	VST-3
Vane type & size		**File**	
Rectangular end, 10.0 x 5.0 cm		Iowa B-6.vct	

Depth 4.880 [m].



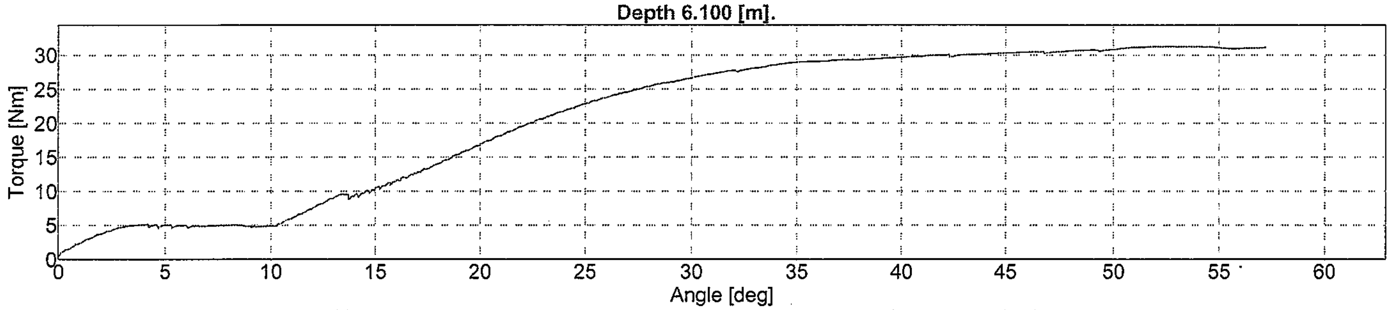
Shear strength = 33.57 [kPa], Max. torque = 17.92 [Nm], Rod friction = 2.66 [Nm]

Depth 4.881 [m]. Remoulded.



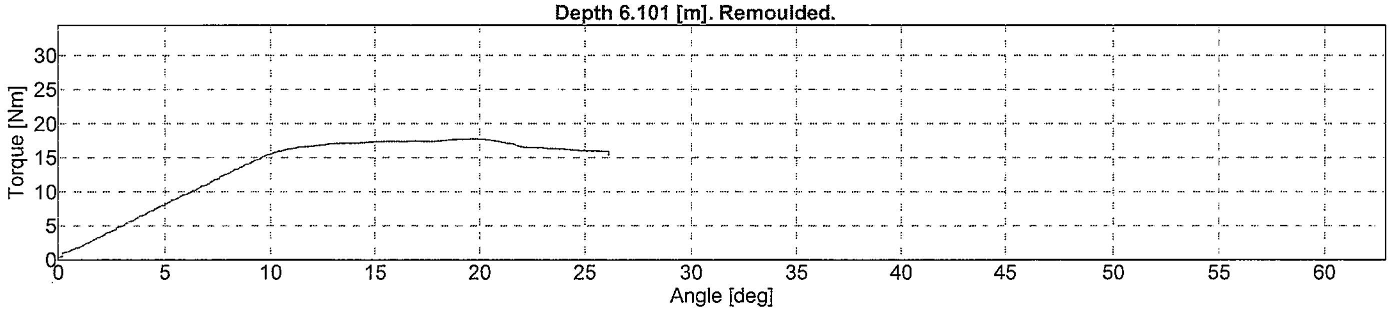
Shear strength = 21.63 [kPa], Max. torque = 12.53 [Nm], Rod friction = 2.70 [Nm]

Depth 6.100 [m].



Shear strength = 58.28 [kPa], Max. torque = 31.30 [Nm], Rod friction = 4.81 [Nm]

Depth 6.101 [m]. Remoulded.



Shear strength = 36.50 [kPa], Max. torque = 17.74 [Nm], Rod friction = 1.15 [Nm]

Terracon
Consulting Engineers & Scientists

Location	Position	Ground level	Test ID.
Riverside Generating Station	See Location Diagram	576	B-7
Project ID	**Client**	**Date**	**Scale**
07105081	HGM Associtesm, Inc.	10/21/2010	1:100
Project		**Page**	**Fig.**
Ash Containment Pond Embankments		1/1	VST-4
Vane type & size		**File**	
Rectangular end, 10.0 x 5.0 cm		IowaB-7-1.vct	

Field Exploration Description

The borings and CPT soundings were performed at the locations selected by Terracon and MEC as shown on the attached Boring Location Sketch (Exhibit A-1). Ground surface elevations indicated on the boring logs are approximate and have been rounded to the nearest foot. The elevations were estimated from the levee cross sections provided by HGM Associates, Inc. The elevations of the soil borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were advanced with a track-mounted drilling rig utilizing continuous flight hollow-stem augers to advance the boreholes. Representative soil samples were obtained using both thin-walled tube and split-barrel sampling procedures. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge is hydraulically pushed into the ground to obtain samples of cohesive and moderately cohesive soils. In the split-barrel sampling procedure, a standard 2-inch (outside diameter) split-barrel sampling spoon is driven into the ground with a 140-pound Central Mine Equipment (CME) automatic SPT hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value and are provided on the boring logs at their depths of occurrence. The blow counts, also referred to as SPT N-values are used to help estimate the relative density of granular soil and the consistency of cohesive soils. The samples were transported to our laboratory for testing and classification. The boreholes were grouted with a cement-bentonite slurry.

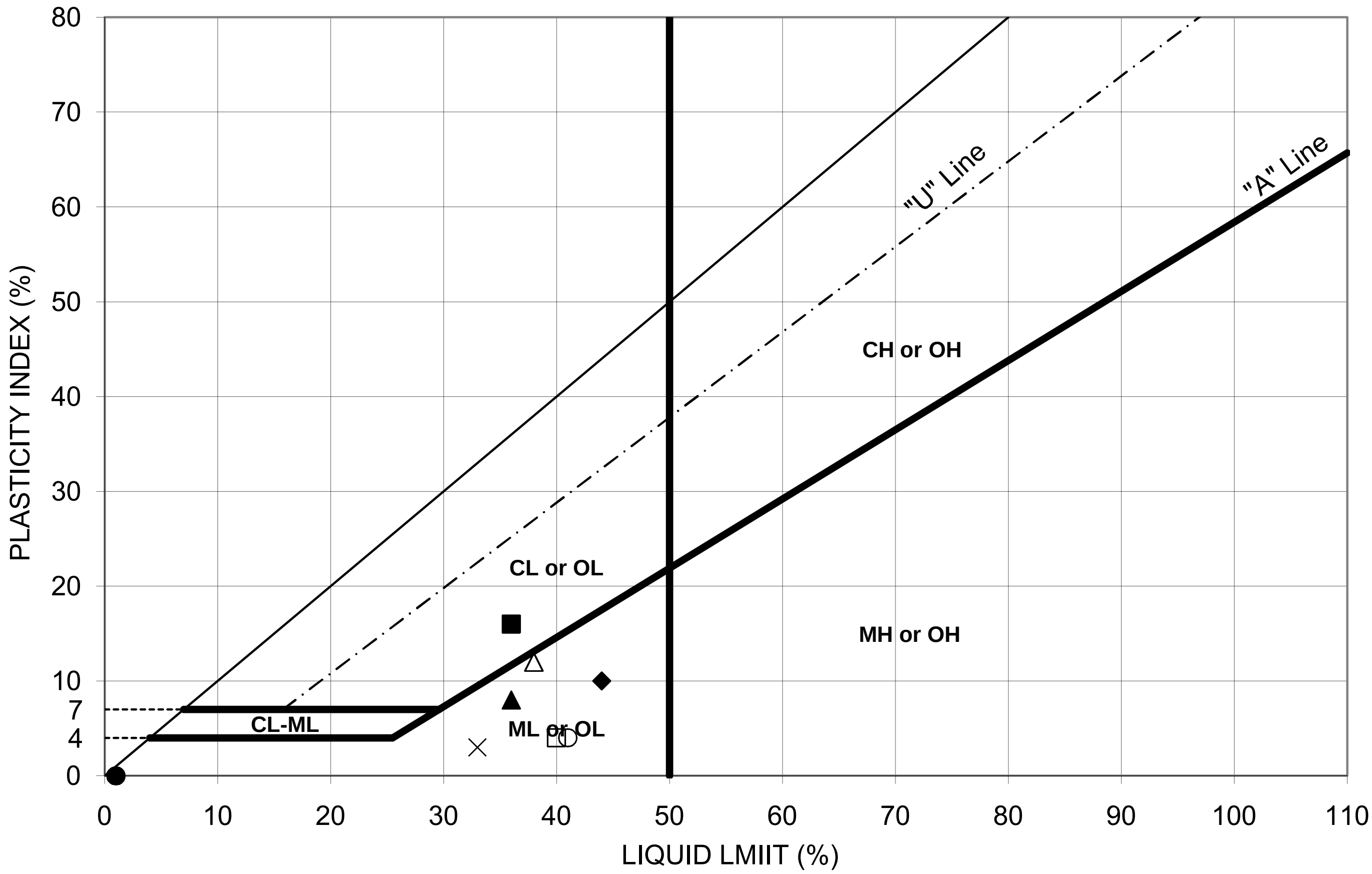
The drill crew prepared a field log for each boring. Each log included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

The CPT soundings were performed using ATV-mounted equipment. The CPT procedure involves hydraulically advancing a steel cone shaped device attached to steel rods with flush-joint couplings. The sounding unit has electronic strain gauges that measure the point resistance, sleeve friction and pore-water pressure. A depth encoder device monitors penetration as the rods are hydraulically pushed into the ground. The system is interfaced with a computer that records the referenced parameters every two to four centimeters. These parameters can be correlated to a variety of soil properties, including strength and density. The in-situ data and the approximate soil types empirically estimated from the data are reported on the attached CPT sounding logs.

The VST analyses were performed with a Geotech EVT 2000 Electrical Field Vane Apparatus using a 65mm by 130mm rectangular end vane within borings at target depths. At the beginning of each test, apparent rod friction was measured during initial rotation through a 20-degree slip-coupling. Remolded tests were performed at selected depths after the initial test and after rotating the vane through 10 revolutions.

APPENDIX B

LABORATORY TESTING



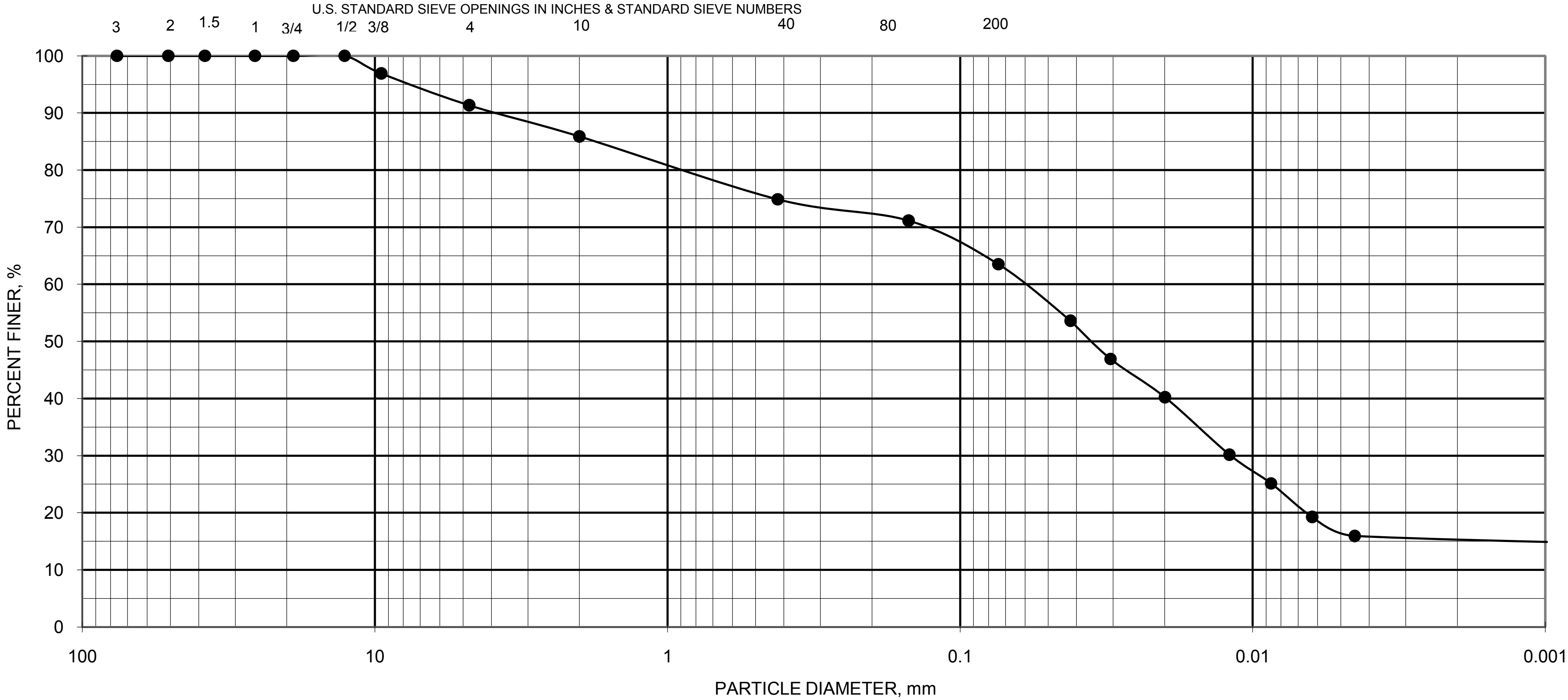
BORING - SAMPLE	DEPTH (feet)	TEST SYMBOL	WATER CONTENT (%)	LL	PI	DESCRIPTION / CLASSIFICATION
B-6/S-4		■		36	16	LEAN CLAY with Sand, dark gray
B-7/S-6		◆		44	10	SILT with Sand, dark gray
B-10/Comp		▲		36	8	SILT with Sand, dark gray with gray-brown
B-5/S-6		●		NP	NP	SILTY SAND, dark gray
B-5/S-7		□		40	4	SILT with Sand, dark gray
B-6/S-5		X		33	3	SANDY SILT, dark gray
B-6/S-7		△		38	12	SILT with Sand, dark gray
B-7/S-7		❍		41	4	SILT with Sand, dark gray
B-6/S-3		❖		NP	NP	SILTY SAND, dark gray
B-7/S-4		+		NP	NP	SILTY SAND, dark gray

PROJECT: Ash Containment Pond Embankment

LOCATION: Riverside Generating Station - Bettendorf, Iowa

PROJECT NUMBER: 07105081

Terracon



GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
B-5	1,2 and 3	Various	Sandy silt, trace gravel	ML				

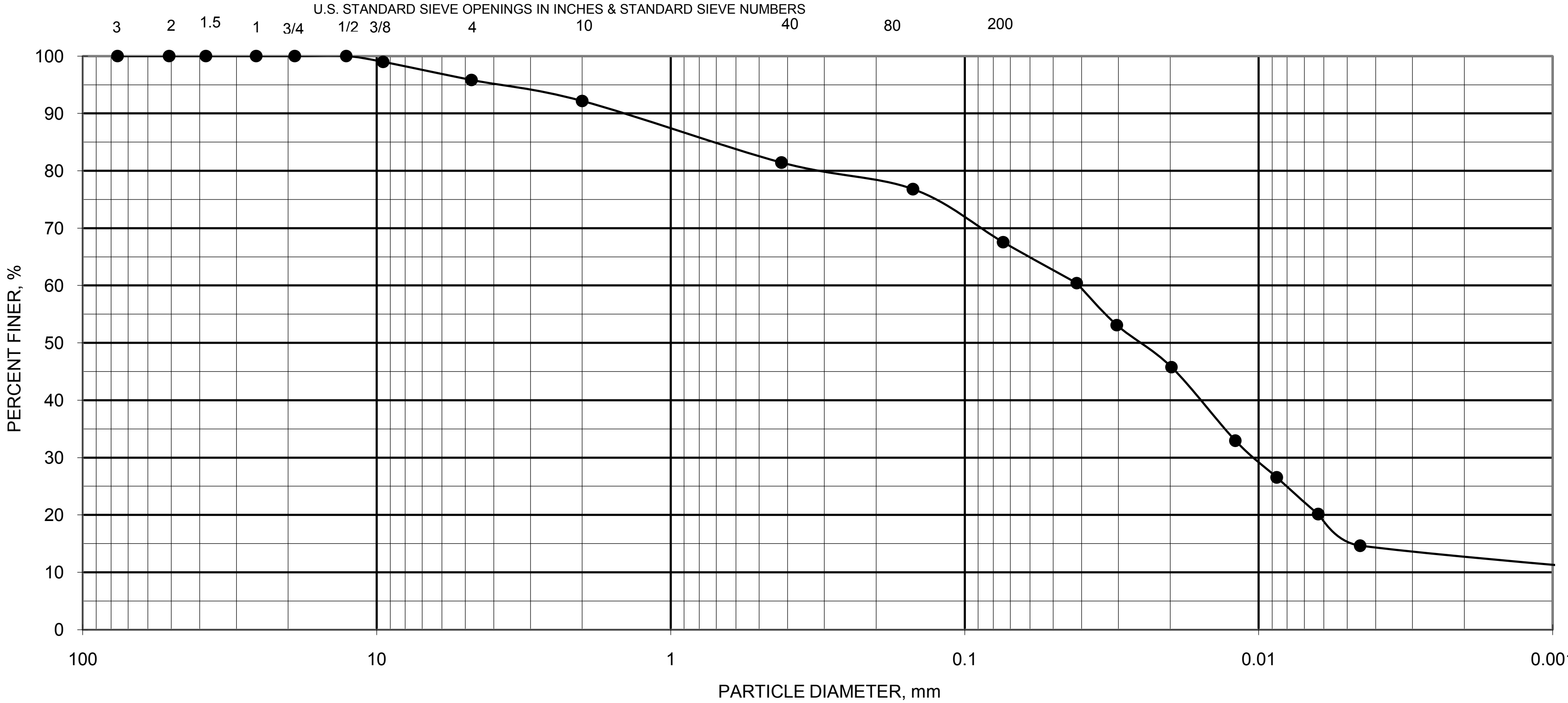
PROJECT Riverside Generating Station

Bettendorf, Iowa

JOB NO. 07105081 DATE 11/22/2010

Terracon

N:\Projects\2010\07105081\[lab data.B.5.1.xls]REPORT



GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
B-6	1 and 2	Various	Sandy silt	ML				

PROJECT Riverside Generating Station

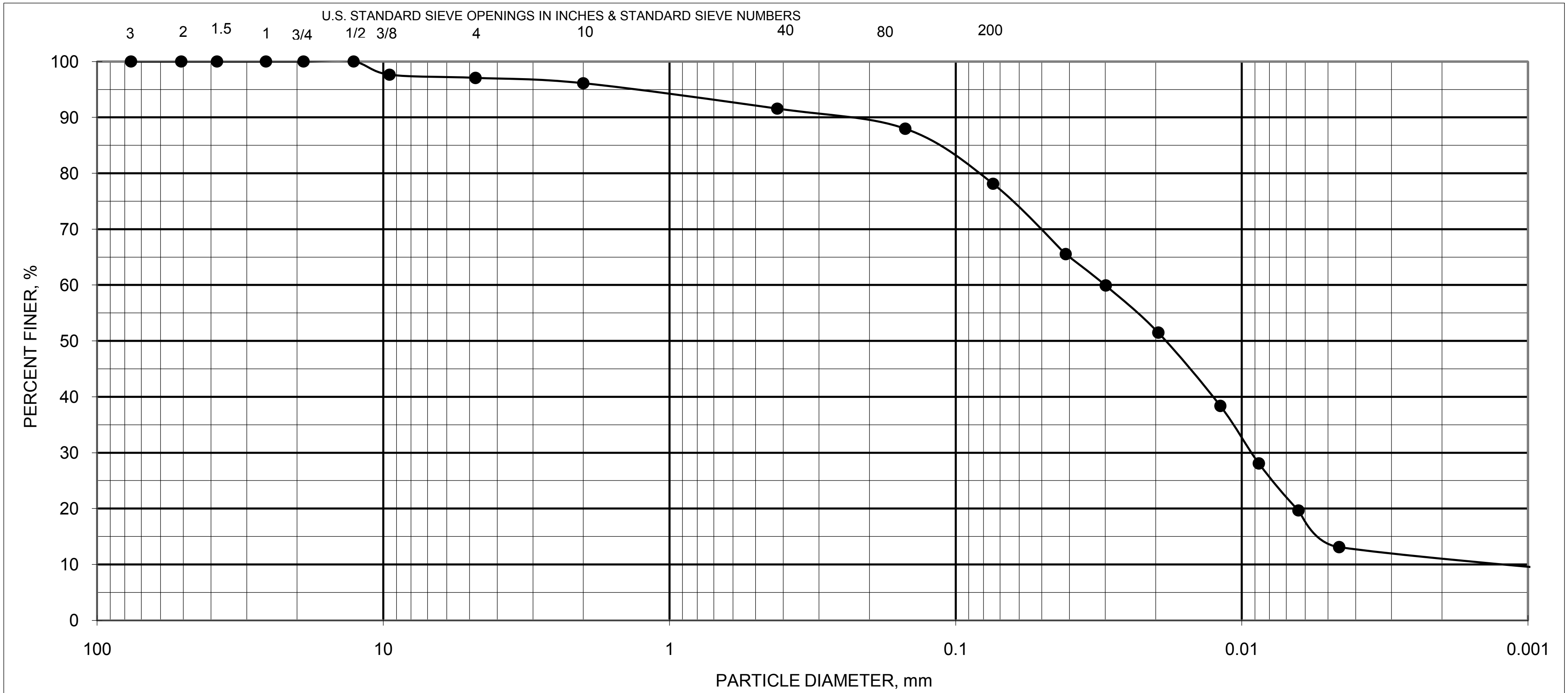
Bettendorf, Iowa

JOB NO. 07105081 DATE 11/22/2010

Terracon

N:\Projects\2010\07105081\[lab data.B.6.1.xls]REPORT

Exhibit B-3



GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

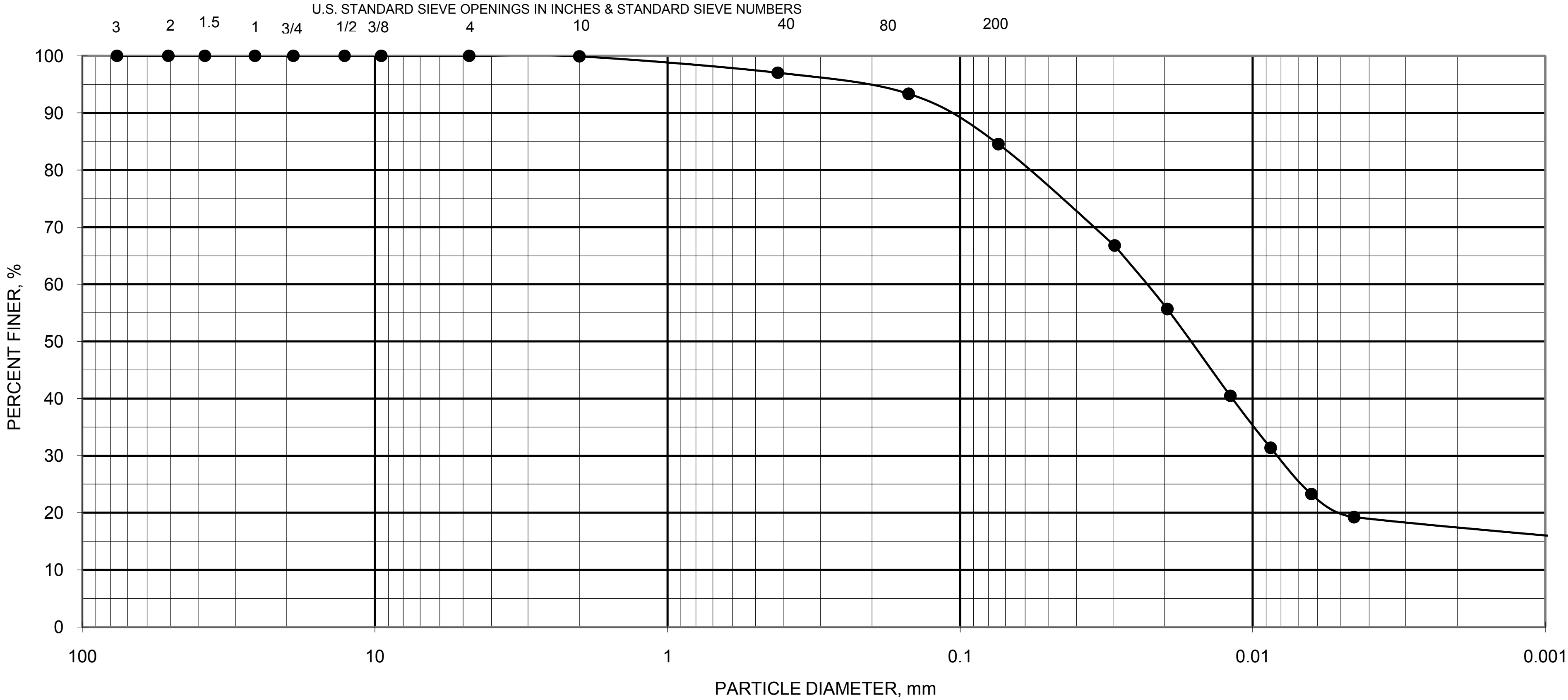
BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
B-8	1 and 2	Various	Silt with sand	ML				

PROJECT Riverside Generating Station

Bettendorf, Iowa JOB NO. 07105081 DATE 11/22/2010

Terracon

N:\Projects\2010\07105081\[lab data.B.8.1.xls]REPORT



GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
B-8	5,7 and 10	Various	Silt with sand	ML				

PROJECT Riverside Generating Station

Bettendorf, Iowa

JOB NO. 07105081 DATE 11/22/2010

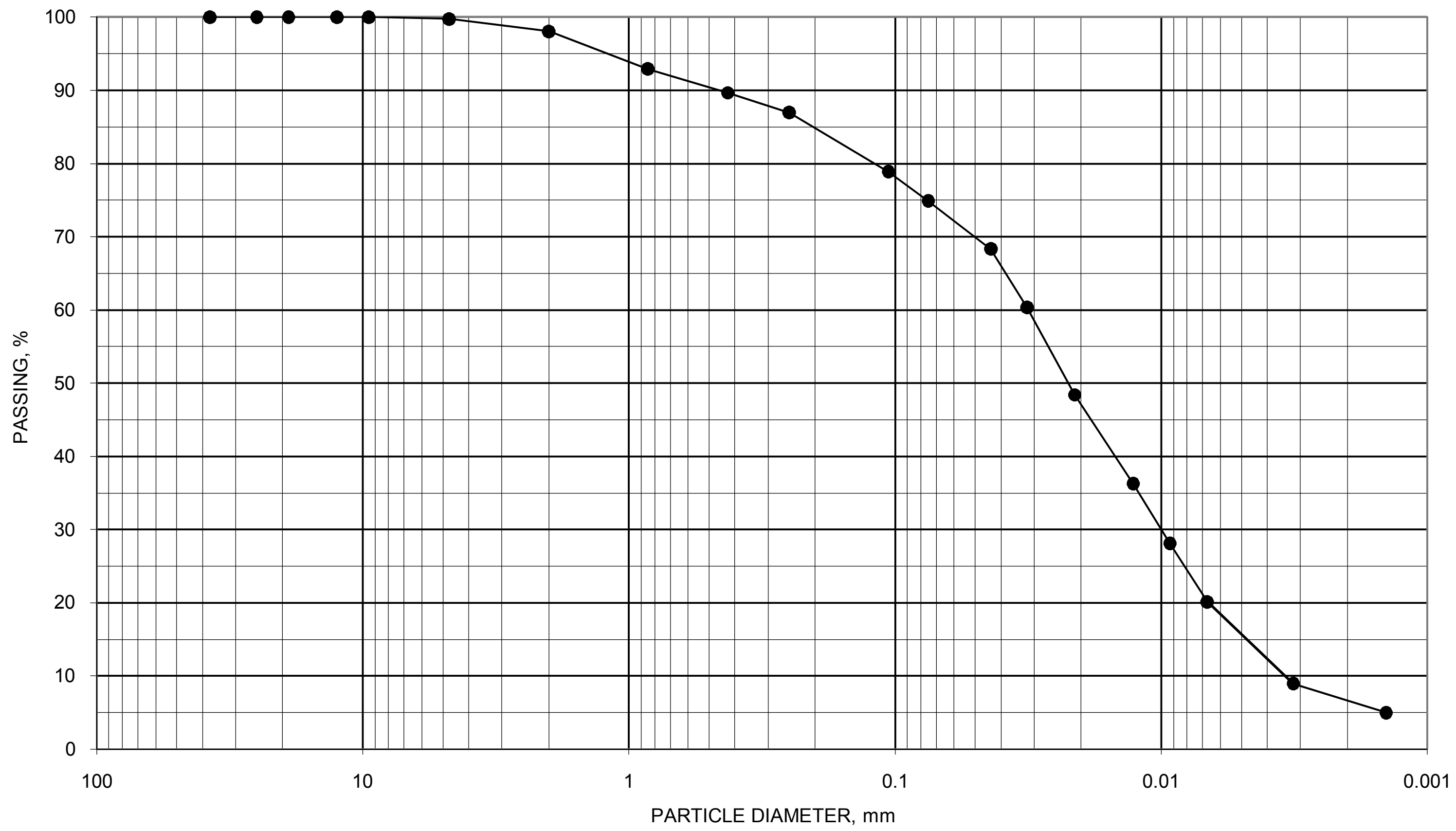
N:\Projects\2010\07105081\[lab data.B.8.5.xls]REPORT

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	100
1/2"	12.5	100
3/8"	9.50	100
#4	4.75	100
#10	2.00	98
#20	0.850	93
#40	0.425	90
#60	0.250	87
#140	0.106	79
#200	0.075	74.9
	0.0437	68.3
	0.0319	60.4
	0.0211	48.4
	0.0127	36.3
	0.0093	28.1
	0.0067	20.1
	0.0032	9.0
	0.0014	5.0

D60	0.0315
D30	0.0100
D10	0.0034
Cu	9.2
Cc	0.9

SPECIFIC GRAVITY 2.54 TESTED



GRAIN SIZE DISTRIBUTION CURVE

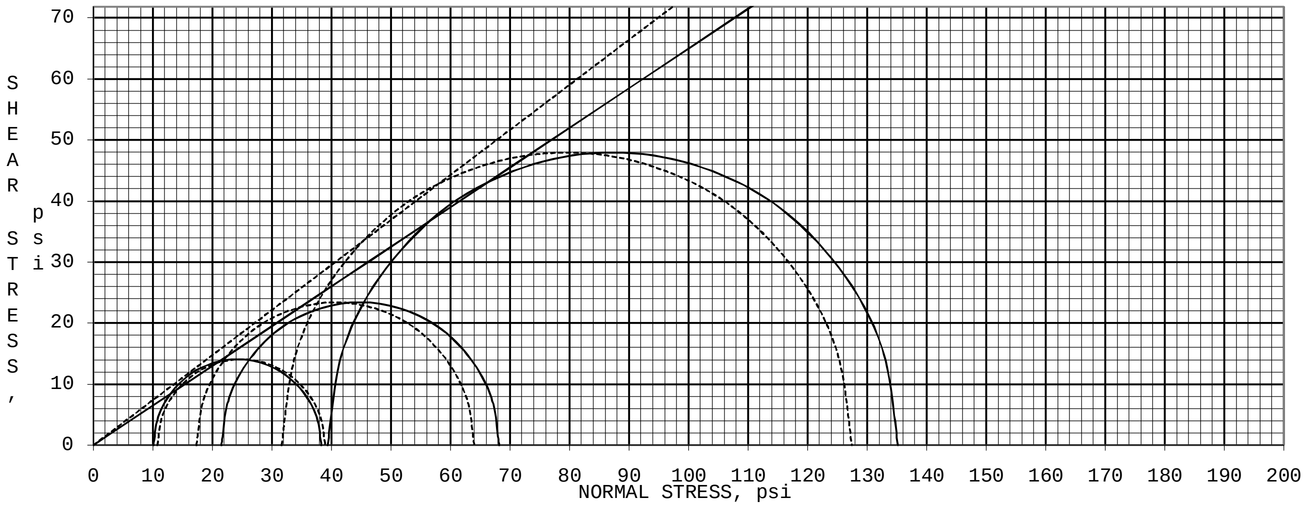
BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-8		5 TO 7	SILT WITH SAND DARK GRAY	ML		NP	NP	NP

PROJECT MEC RIVERSIDE ASH POND

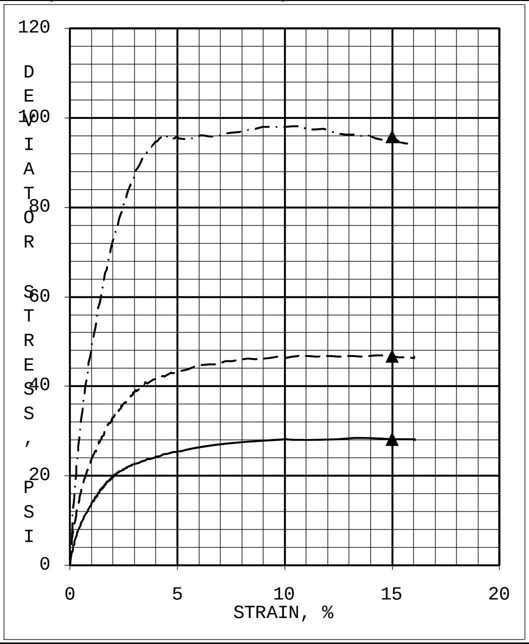
JOB NO. 02105081G DATE 11/11/2010

N:\PROJECTS\2010\02105081G\Lab Data\[02105081G HydroALPlot B8&B9-COMP-15.0.xlsm]REPORT

Exhibit B-6



	EFFECTIVE STRESS ---	ANGLE OF INTERNAL FRICTION, deg	**36.4**	COHESION, psi	**0.0**
	TOTAL STRESS ——	ANGLE OF INTERNAL FRICTION, deg	**33.0**	COHESION, psi	**0.0**



SPECIMEN ID:		A	B	C
INITIAL	WATER CONTENT, %	37.9	37.7	36.9
	DRY DENSITY, pcf	69.3	69.4	69.0
	SATURATION, %	75	75	72
	VOID RATIO	1.29	1.29	1.30
BEFORE SHEAR	WATER CONTENT, %	50.1	49.0	48.9
	DRY DENSITY, pcf	69.8	70.6	70.7
	SATURATION (B PARAMETER)	0.97	1.00	0.97
	VOID RATIO	1.27	1.25	1.24
	FINAL BACK PRESSURE, psi	98.6	98.9	101.2
MINOR PRINCIPAL STRESS, psi		10.2	21.5	39.4
EFFECTIVE STRESS PEAK AT % STRAIN		15.0	15.0	15.0
EFF. DEVIATOR STRESS AT PEAK STRAIN, psi		28.2	46.7	95.8
TOTAL STRESS PEAK AT % STRAIN		15.0	15.0	15.0
TOTAL DEVIATOR STRESS AT PEAK STRAIN, psi		28.2	46.7	95.8
ULTIMATE DEVIATOR STRESS (15% STR), psi		28.2	46.7	95.7
TIME TO 50% PRIMARY CONSOLIDATION, min		0.23	0.18	0.23
STRAIN RATE, % / hour		8.04	8.03	8.03
INITIAL DIAMETER, inch		1.998	2.000	2.008
INITIAL HEIGHT, inch		4.047	4.034	4.056
AREA AFTER CONSOLIDATION, inch2		3.132	3.116	3.117

CONTROLLED - STRAIN TEST

SAMPLE TYPE: RE-COMPACTED

DESCRIPTION OF SPECIMENS:
SILT WITH SAND, DARK GRAY

LL	NP	PL	NP	PI	NP	Gs	2.54 TEST

PROJECT NO. 02105081G	PROJECT: MEC RIVERSIDE ASH POND
	BORING #: B-8
LABORATORY: TERRACON - LENEXA	SAMPLE #:
DATE: 6/13/2008	DEPTH, feet: 5.0 - 7.0

PROCEDURE: ASTM D4767, CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS

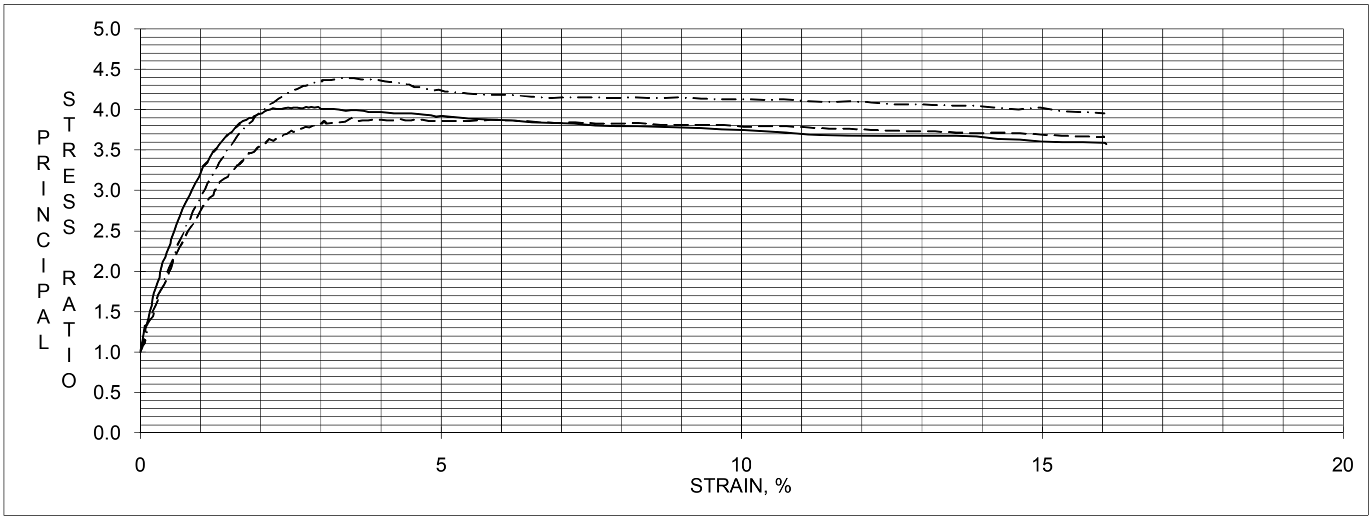
Terracon

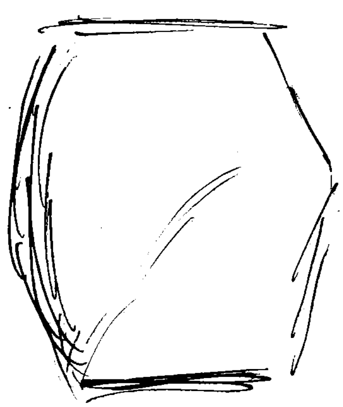
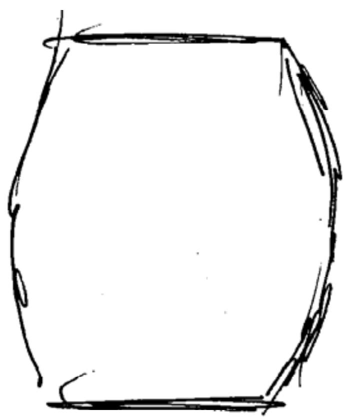
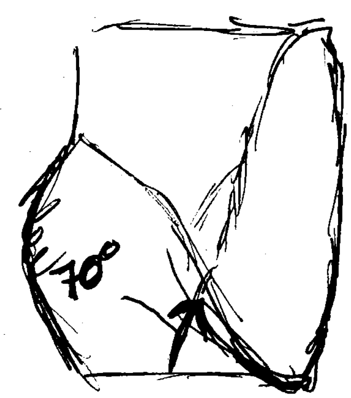
N:\PROJECTS\2010\02105081G\Lab Data\[02105081G Triaxial CU B8-5.0.15 percent.xlsx]REPORT

Exhibit B-7

MEC RIVERSIDE ASH POND

02105081G B-8 0 5.0 - 7.0



FAILURE SKETCH	FAILURE SKETCH	FAILURE SKETCH
		
SPECIMEN A	SPECIMEN B	SPECIMEN C

REMARKS:

SPECIMENS SATURATED BY THE WET METHOD.

EFFECTIVE STRESS FAILURE DATA BASED ON 15 % STRAIN.

EFFECTIVE STRESS MOHR'S CIRCLES DRAWN AT 15 % STRAIN.

TOTAL STRESS FAILURE DATA BASED ON 15 % STRAIN.

TOTAL STRESS MOHR'S CIRCLES DRAWN AT 15 % STRAIN.

DEVIATOR STRESSES CORRECTED FOR MEMBRANE AND FILTER PAPER EFFECTS.

AREA AFTER CONSOLIDATION CALCULATED AS PER SECTION 10.3.2.1 METHOD A

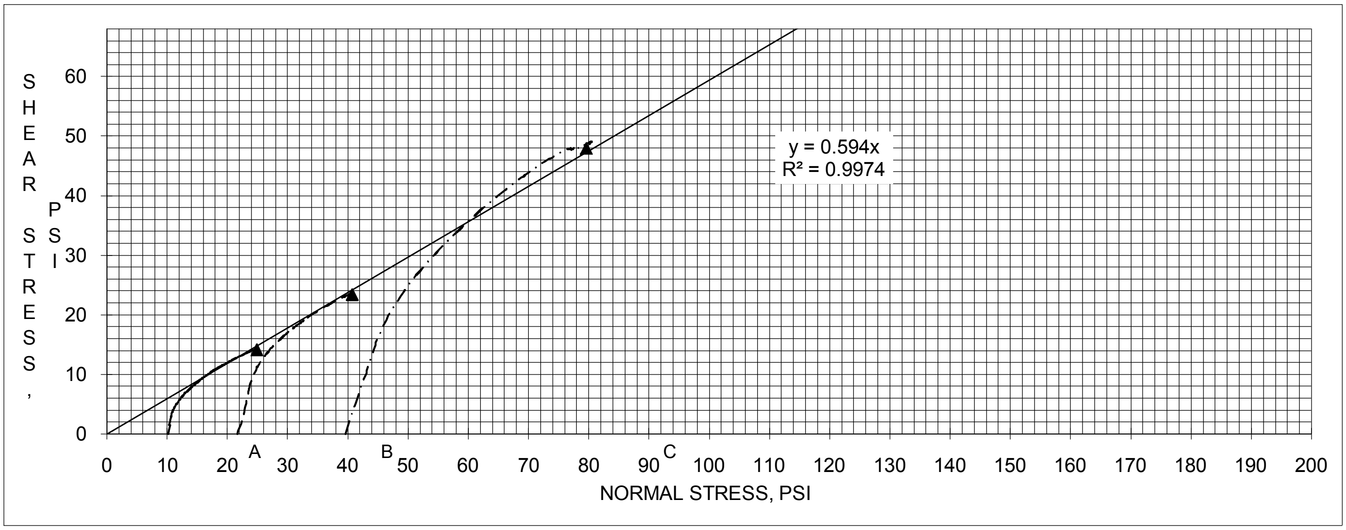
STANDARD PROCTOR = 85pcf @ 25% MOISTURE

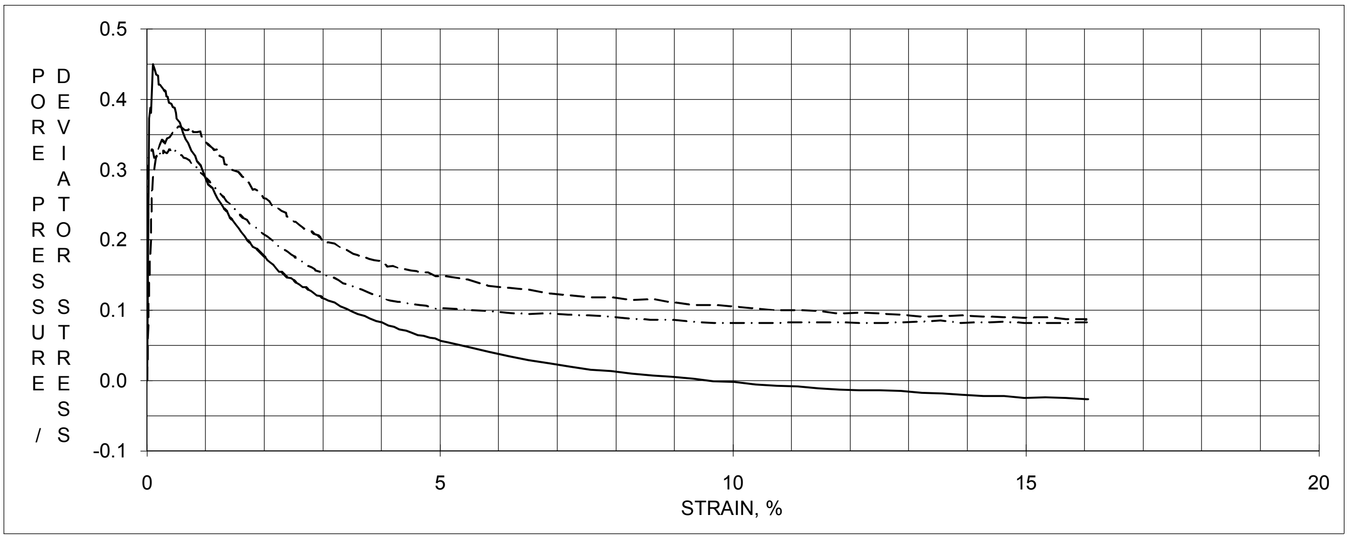
REMOLDED TO 69.2 pcf @ 37.5% MOISTURE REMOLDED TO 81.5% COMPACTION

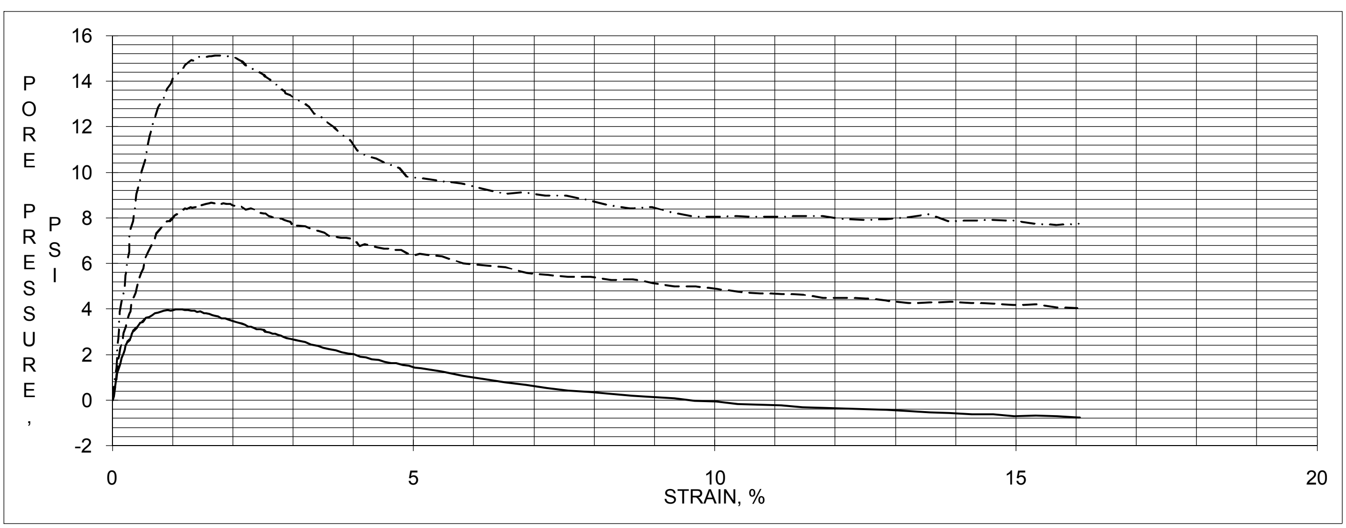
Terracon

MEC RIVERSIDE ASH POND

02105081G B-8 0 5.0 - 7.0





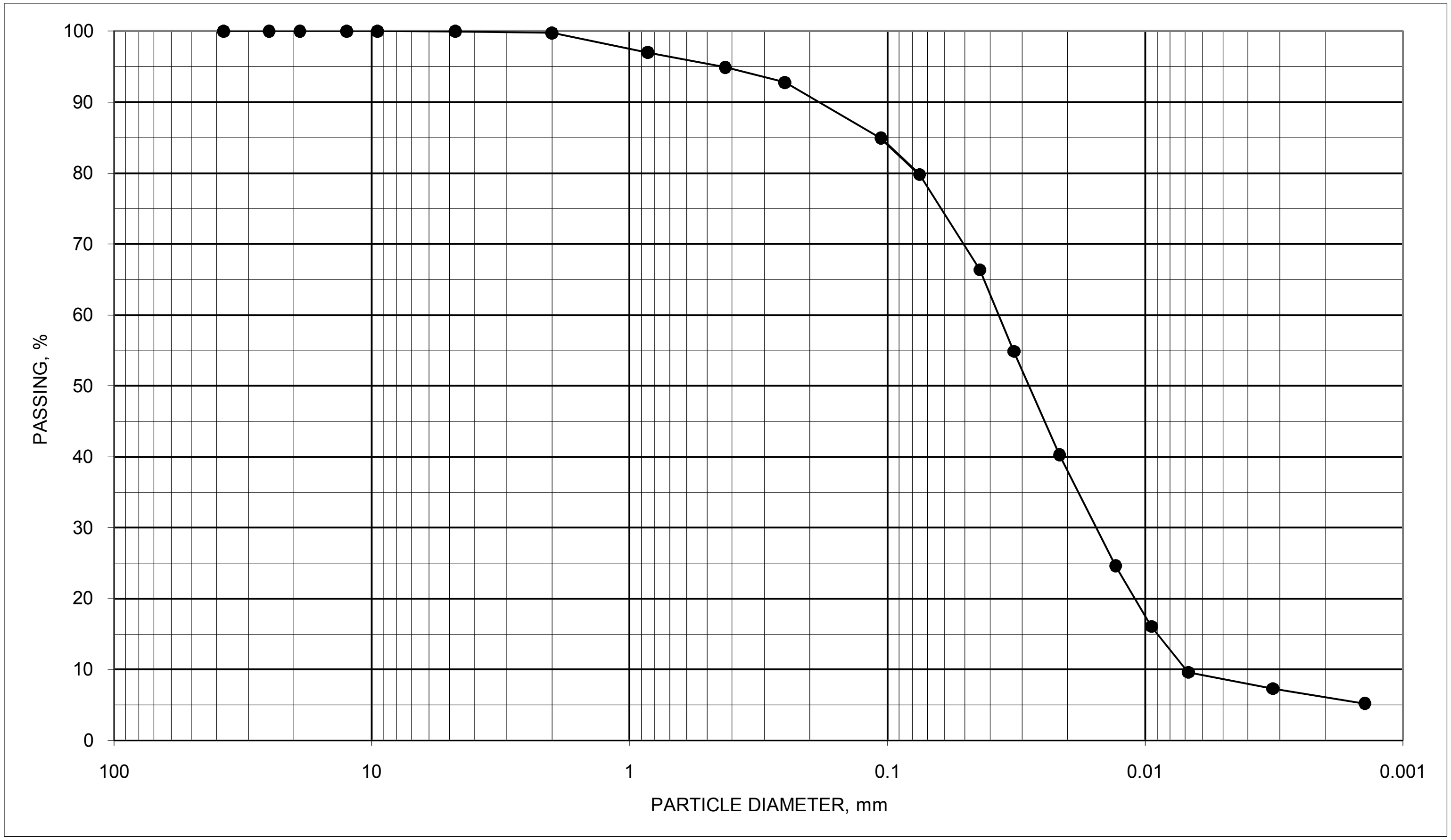


Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
1.5"	37.5	100
1"	25.0	100
3/4"	19.0	100
1/2"	12.5	100
3/8"	9.50	100
#4	4.75	100
#10	2.00	100
#20	0.850	97
#40	0.425	95
#60	0.250	93
#140	0.106	85
#200	0.075	79.8
	0.0438	66.4
	0.0323	54.9
	0.0215	40.3
	0.0130	24.6
	0.0095	16.1
	0.0068	9.6
	0.0032	7.3
	0.0014	5.2

D60	0.0370
D30	0.0155
D10	0.0069
Cu	5.3
Cc	0.9

SPECIFIC GRAVITY 2.60 TESTED



GRAIN SIZE DISTRIBUTION CURVE

BORING ID	SAMPLE ID	DEPTH, feet	USCS DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
B-8 & B-9	Composite	15 TO 22.5	SILT WITH SAND DARK GRAY	ML		NP	NP	NP

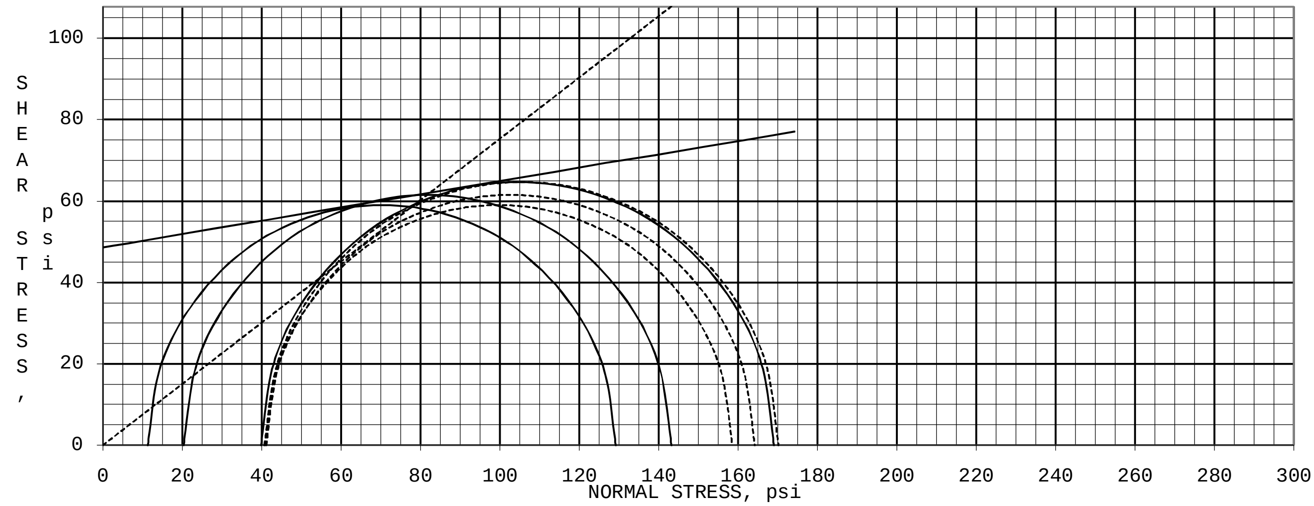
PROJECT MEC RIVERSIDE ASH POND

JOB NO. 02105081G DATE 11/11/2010

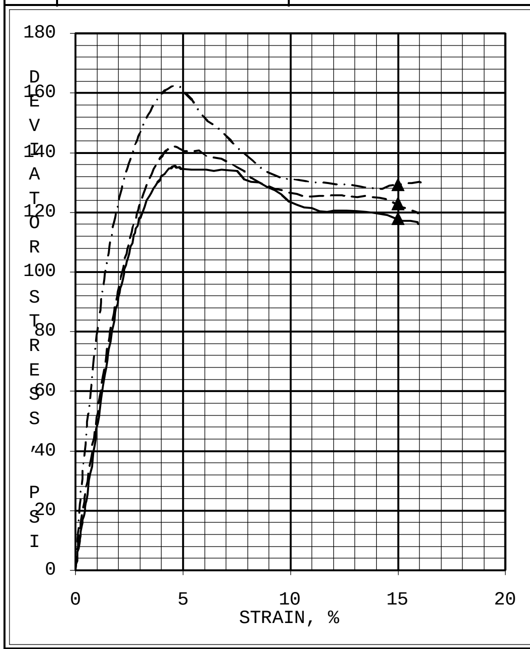
N:\PROJECTS\2010\02105081G\Lab Data\[02105081G HydroALPlot B8&B9-COMP-15.0.xlsm]REPORT

Terracon

Exhibit B-10



EFFECTIVE STRESS ---	ANGLE OF INTERNAL FRICTION, deg	**37.0**	COHESION, psi	**0.0**
TOTAL STRESS ——	ANGLE OF INTERNAL FRICTION, deg	**9.3**	COHESION, psi	**48.5**



SPECIMEN ID:		A	B	C
INITIAL	WATER CONTENT, %	29.0	29.1	28.7
INITIAL	DRY DENSITY, pcf	70.6	70.6	71.1
INITIAL	SATURATION, %	58	58	58
INITIAL	VOID RATIO	1.30	1.30	1.29
BEFORE SHEAR	WATER CONTENT, %	49.5	49.2	48.4
BEFORE SHEAR	DRY DENSITY, pcf	71.0	71.2	71.9
BEFORE SHEAR	SATURATION (B PARAMETER)	0.99	0.95	1.00
BEFORE SHEAR	VOID RATIO	1.29	1.28	1.26
BEFORE SHEAR	FINAL BACK PRESSURE, psi	99.2	99.3	99.7
MINOR PRINCIPAL STRESS, psi		11.3	20.3	39.8
EFFECTIVE STRESS PEAK AT % STRAIN		15.0	15.0	15.0
EFF. DEVIATOR STRESS AT PEAK STRAIN, psi		118.0	122.9	129.3
TOTAL STRESS PEAK AT % STRAIN		15.0	15.0	15.0
TOTAL DEVIATOR STRESS AT PEAK STRAIN, psi		118.0	122.9	129.3
ULTIMATE DEVIATOR STRESS (15% STR), psi		117.7	122.5	129.3
TIME TO 50% PRIMARY CONSOLIDATION, min		0.18	0.14	0.13
STRAIN RATE, % / hour		8.04	8.04	8.04
INITIAL DIAMETER, inch		2.006	2.003	2.004
INITIAL HEIGHT, inch		4.059	4.067	4.049
AREA AFTER CONSOLIDATION, inch2		3.155	3.135	3.139

CONTROLLED - STRAIN TEST

SAMPLE TYPE: RE-COMPACTED

DESCRIPTION OF SPECIMENS:
SILT WITH SAND, DARK GRAY

LL	NP	PL	NP	PI	NP	Gs	2.6 TEST

PROJECT NO. 02105081G

PROJECT: MEC RIVERSIDE ASH POND

BORING #: B-8 & B-9

LABORATORY: TERRACON - LENEXA

SAMPLE #: COMPOSITE

DATE: 6/13/2008

DEPTH, feet: 15.0 - 21.0 & 20.5 - 22.5

PROCEDURE: ASTM D4767, CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS

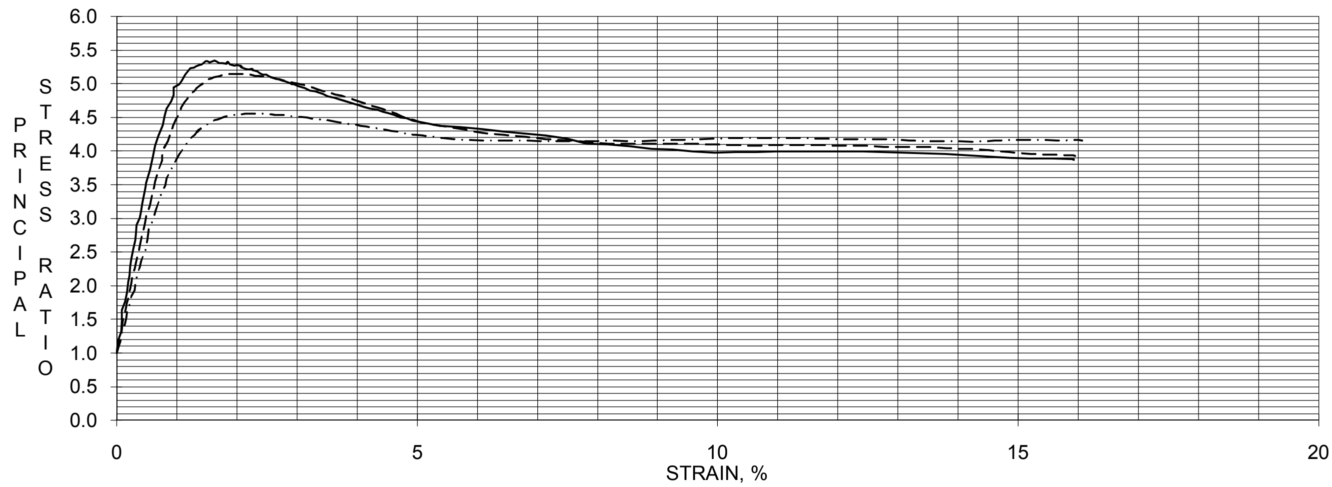
Terracon

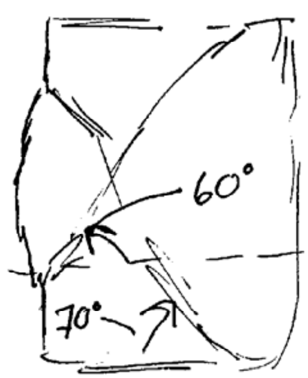
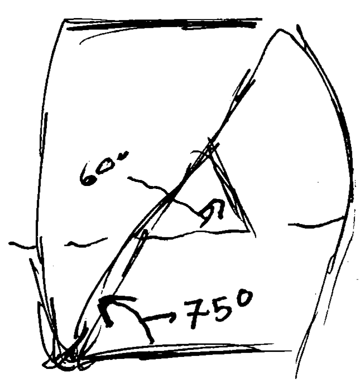
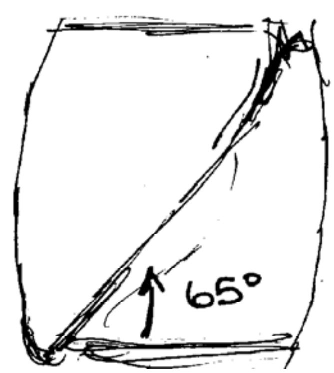
N:\PROJECTS\2010\02105081G\Lab Data\Prelim CU Analyses\[02105081G Triaxial CU B8&B9-COMP-15.0.15 percent.xlsx]File Data Combined

Exhibit B-11

MEC RIVERSIDE ASH POND

02105081G | B-8 & B-9 | COMPOSITE | 15.0 - 21.0 & 20.5 - 22.5



FAILURE SKETCH	FAILURE SKETCH	FAILURE SKETCH
		
SPECIMEN A	SPECIMEN B	SPECIMEN C

REMARKS:

SPECIMENS SATURATED BY THE WET METHOD.

EFFECTIVE STRESS FAILURE DATA BASED ON 15 % STRAIN.

EFFECTIVE STRESS MOHR'S CIRCLES DRAWN AT 15 % STRAIN.

TOTAL STRESS FAILURE DATA BASED ON 15 % STRAIN.

TOTAL STRESS MOHR'S CIRCLES DRAWN AT 15 % STRAIN.

DEVIATOR STRESSES CORRECTED FOR MEMBRANE AND FILTER PAPER EFFECTS.

AREA AFTER CONSOLIDATION CALCULATED AS PER SECTION 10.3.2.1 METHOD A

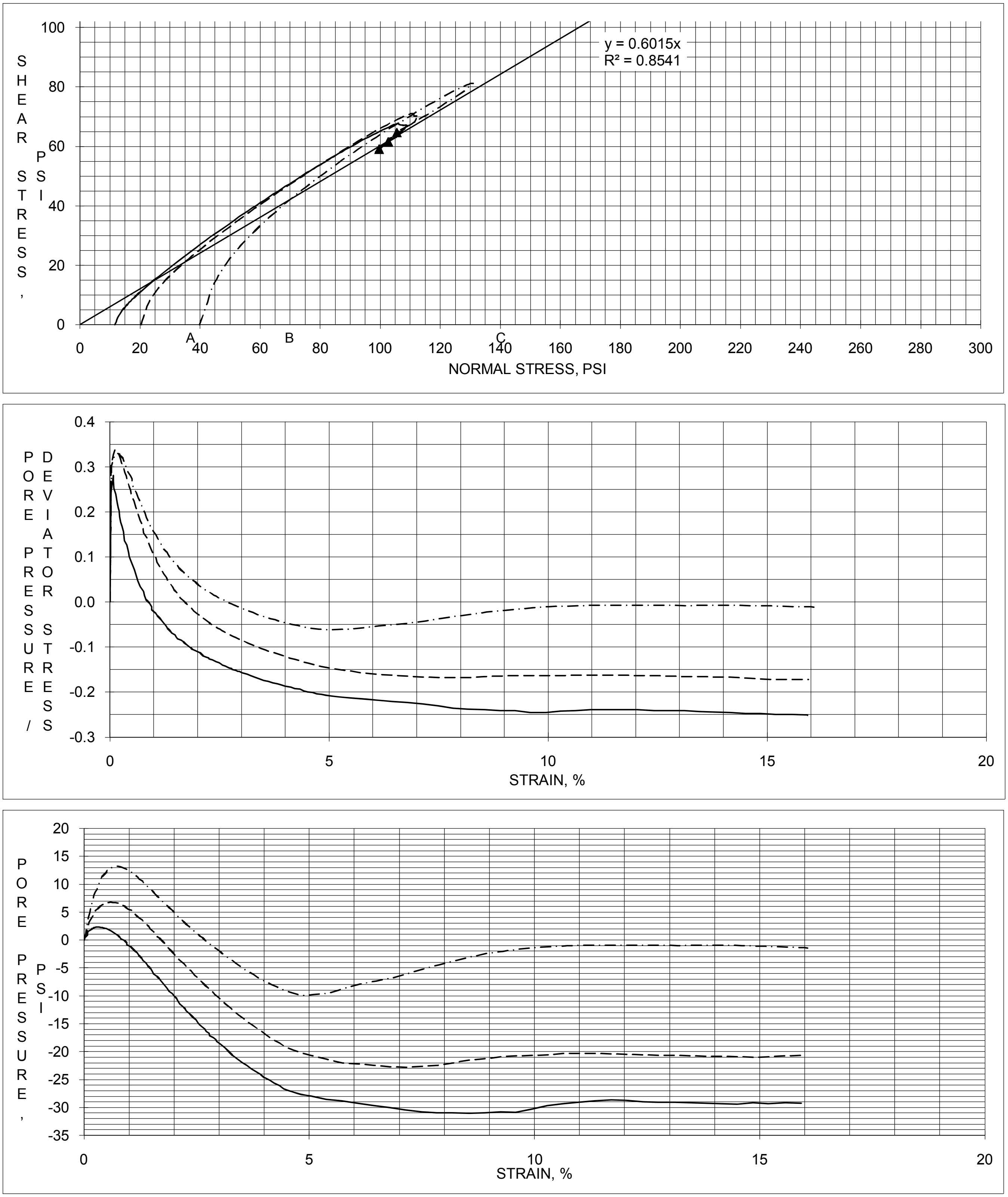
STANDARD PROCTOR = 75pcf @ 25% MOISTURE

REMOLDED TO 70.7 pcf @ 28.9% MOISTURE REMOLDED TO 94.3% COMPACTION

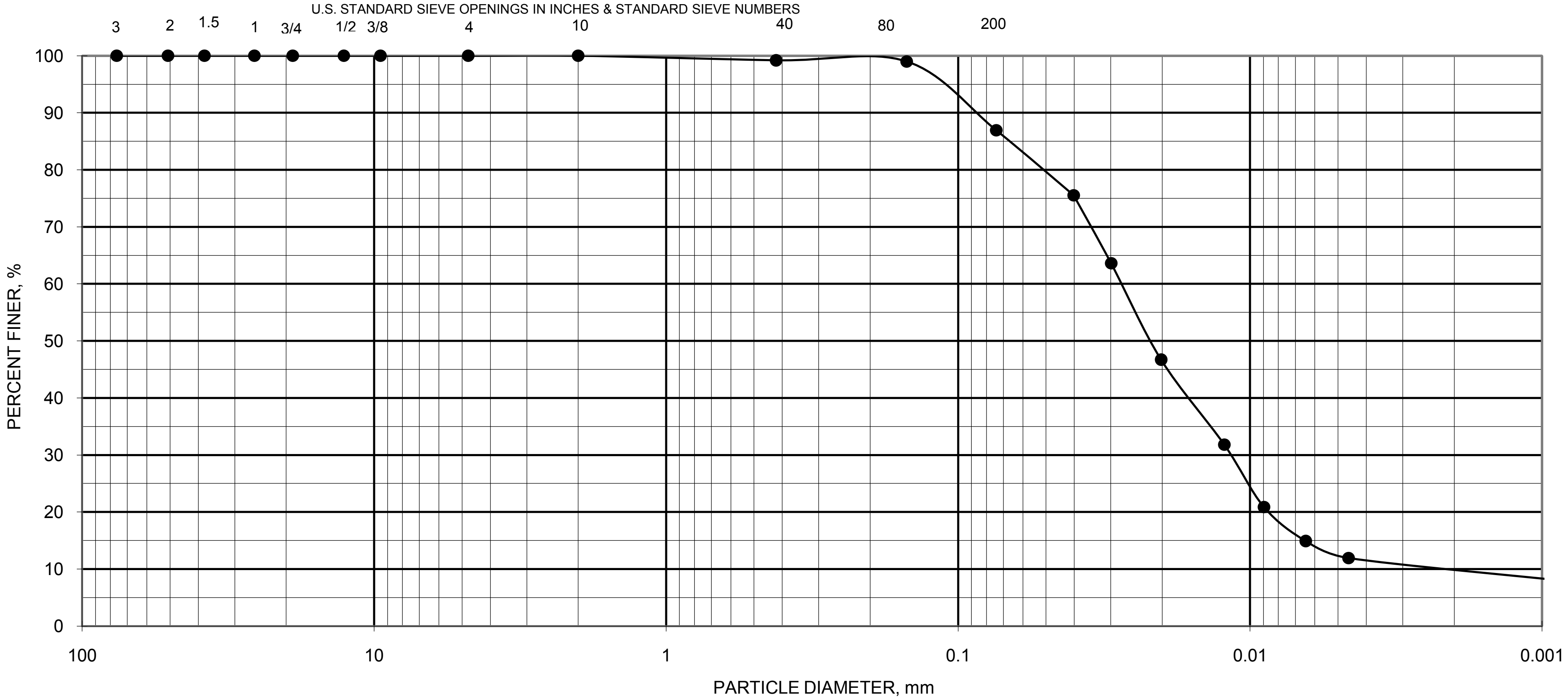
Terracon

MEC RIVERSIDE ASH POND

02105081G B-8 & B-9 COMPOSITE 15.0 - 21.0 & 20.5



Terracon



GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

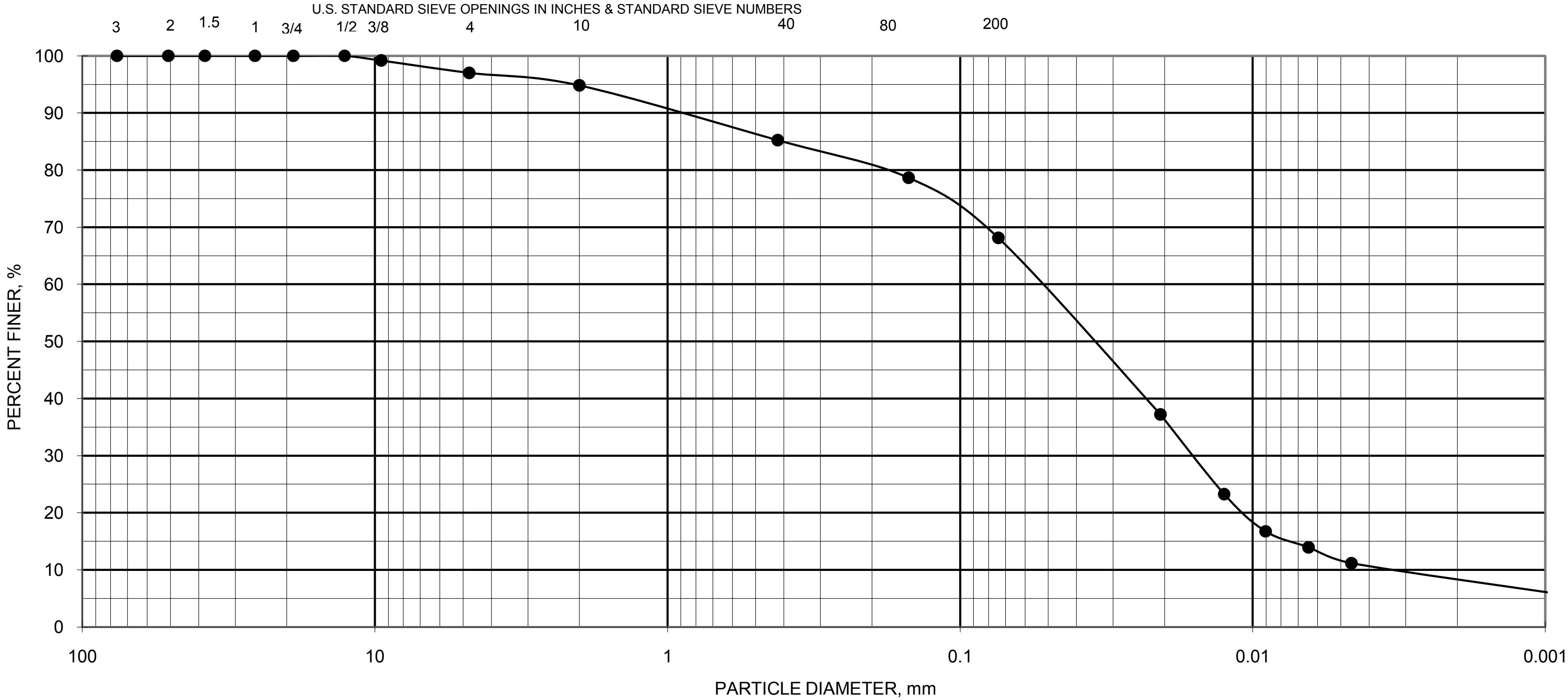
BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
B-9	6	22-24	Silt	ML				

PROJECT Riverside Generating Station

Bettendorf, Iowa JOB NO. 07105081 DATE 11/22/2010

N:\Projects\2010\07105081\Lab Data\[lab data.B.9.6.xls]REPORT

Exhibit B-14



GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

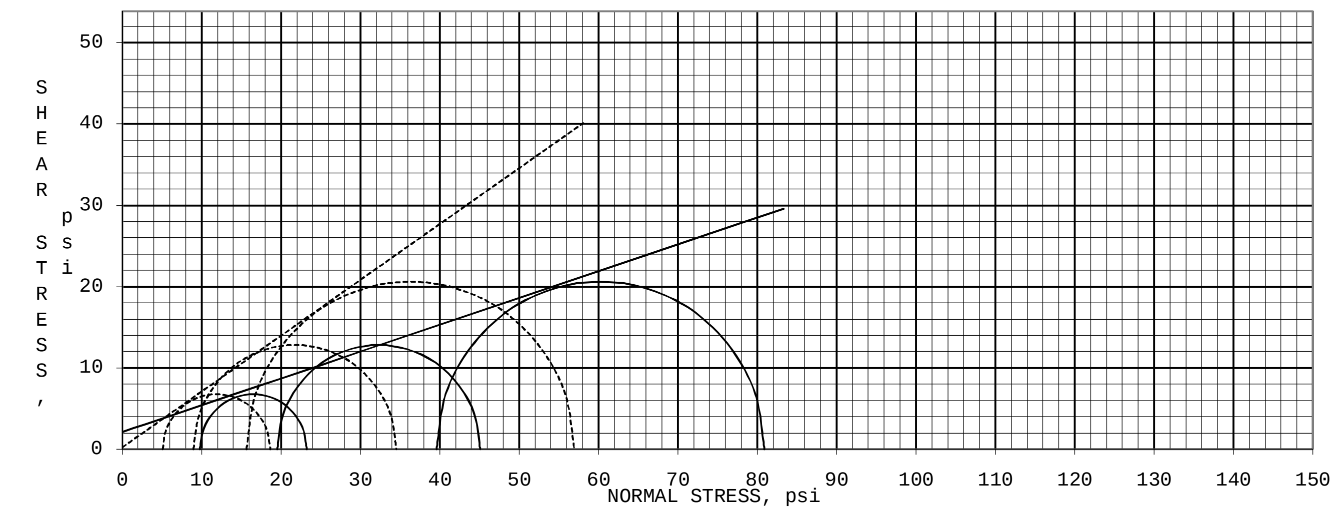
BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
B-11	5 and 6	Various	Sandy silt	ML				

PROJECT Riverside Generating Station

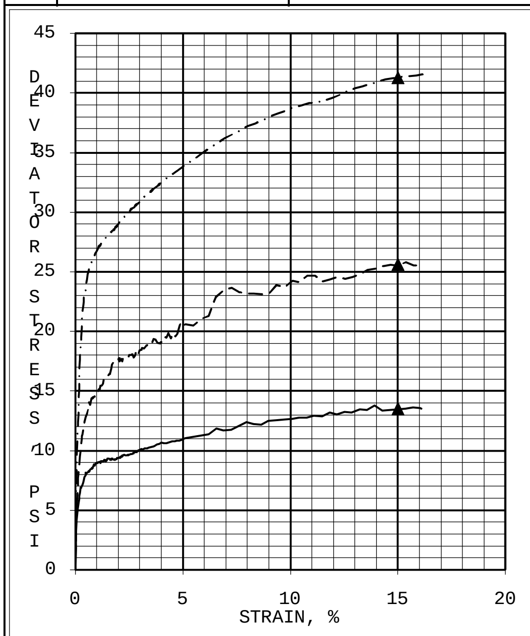
Bettendorf, Iowa JOB NO. 07105081 DATE 11/22/2010

N:\Projects\2010\07105081\Lab Data\[lab data.B.11.5.xls]REPORT

Terracon



EFFECTIVE STRESS ---	ANGLE OF INTERNAL FRICTION, deg	**34.5**	COHESION, psi	**0.2**
TOTAL STRESS ——	ANGLE OF INTERNAL FRICTION, deg	**18.3**	COHESION, psi	**2.1**



SPECIMEN ID:		A	B	C
INITIAL	WATER CONTENT, %	29.3	29.7	29.8
INITIAL	DRY DENSITY, pcf	88.9	88.6	86.3
INITIAL	SATURATION, %	90	90	86
INITIAL	VOID RATIO	0.87	0.88	0.93
BEFORE SHEAR	WATER CONTENT, %	31.4	30.3	30.5
BEFORE SHEAR	DRY DENSITY, pcf	90.5	92.0	91.7
BEFORE SHEAR	SATURATION (B PARAMETER)	1.00	0.98	0.95
BEFORE SHEAR	VOID RATIO	0.84	0.81	0.81
BEFORE SHEAR	FINAL BACK PRESSURE, psi	99.1	99.3	99.9
MINOR PRINCIPAL STRESS, psi		9.8	19.5	39.6
EFFECTIVE STRESS PEAK AT % STRAIN		15.0	15.0	15.0
EFF. DEVIATOR STRESS AT PEAK STRAIN, psi		13.5	25.6	41.3
TOTAL STRESS PEAK AT % STRAIN		15.0	15.0	15.0
TOTAL DEVIATOR STRESS AT PEAK STRAIN, psi		13.5	25.6	41.3
ULTIMATE DEVIATOR STRESS (15% STR), psi		13.5	25.7	41.3
TIME TO 50% PRIMARY CONSOLIDATION, min		1.20	1.10	0.91
STRAIN RATE, % / hour		8.03	8.22	8.23
INITIAL DIAMETER, inch		2.005	2.006	2.021
INITIAL HEIGHT, inch		3.911	3.914	3.956
AREA AFTER CONSOLIDATION, inch2		3.121	3.075	3.071

CONTROLLED - STRAIN TEST

SAMPLE TYPE: RE-COMPACTED

DESCRIPTION OF SPECIMENS:

SILT WITH SAND, DARK GRAY WITH GRAYISH BROWN

LL 36	PL 28	PI 8	Gs 2.67 TEST

PROJECT NO. 02105081G

PROJECT: MEC RIVERSIDE ASH POND

BORING #: B-10

LABORATORY: TERRACON - LENEXA

SAMPLE #: COMPOSITE

DATE: 6/13/2008

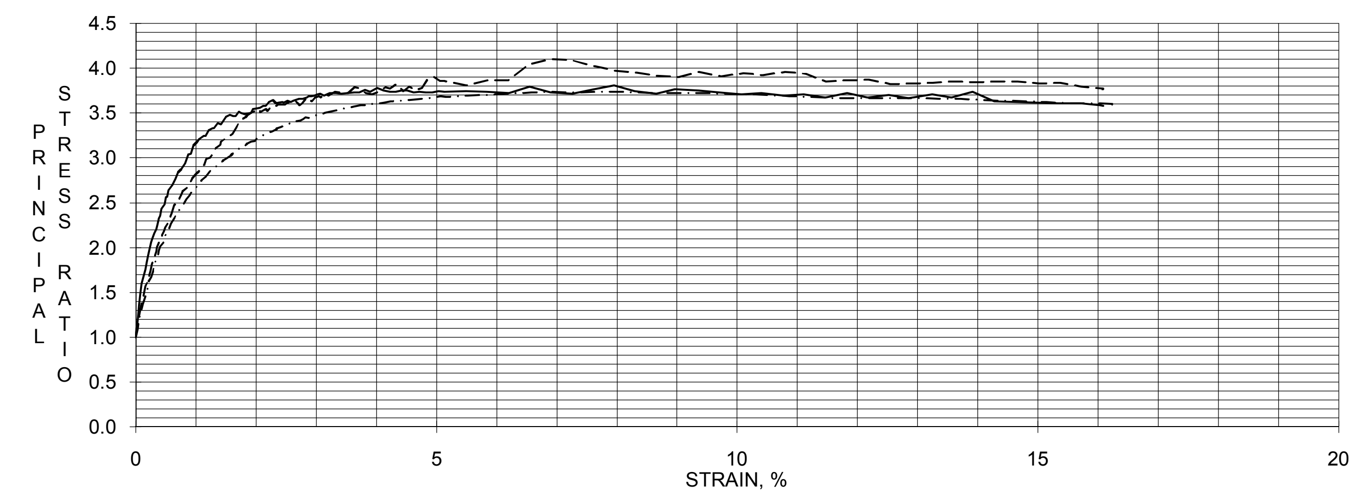
DEPTH, feet: 13.0 - 18.0

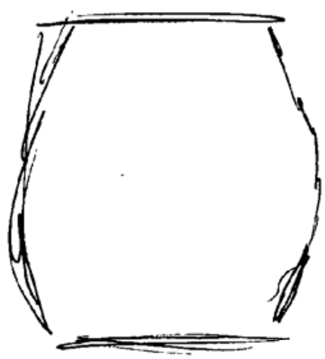
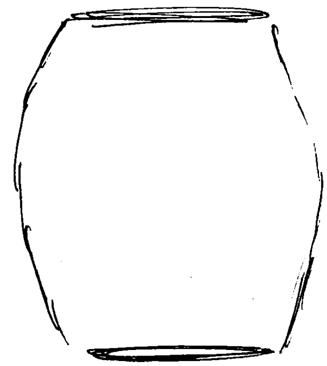
PROCEDURE: ASTM D4767, CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST ON COHESIVE SOILS

Terracon

MEC RIVERSIDE ASH POND

02105081G B-10 COMPOSITE 13.0 - 18.0



FAILURE SKETCH	FAILURE SKETCH	FAILURE SKETCH
		
SPECIMEN A	SPECIMEN B	SPECIMEN C

REMARKS:

SPECIMENS SATURATED BY THE WET METHOD.

EFFECTIVE STRESS FAILURE DATA BASED ON 15 % STRAIN.

EFFECTIVE STRESS MOHR'S CIRCLES DRAWN AT 15 % STRAIN.

TOTAL STRESS FAILURE DATA BASED ON 15 % STRAIN.

TOTAL STRESS MOHR'S CIRCLES DRAWN AT 15 % STRAIN.

DEVIATOR STRESSES CORRECTED FOR MEMBRANE AND FILTER PAPER EFFECTS.

AREA AFTER CONSOLIDATION CALCULATED AS PER SECTION 10.3.2.1 METHOD A

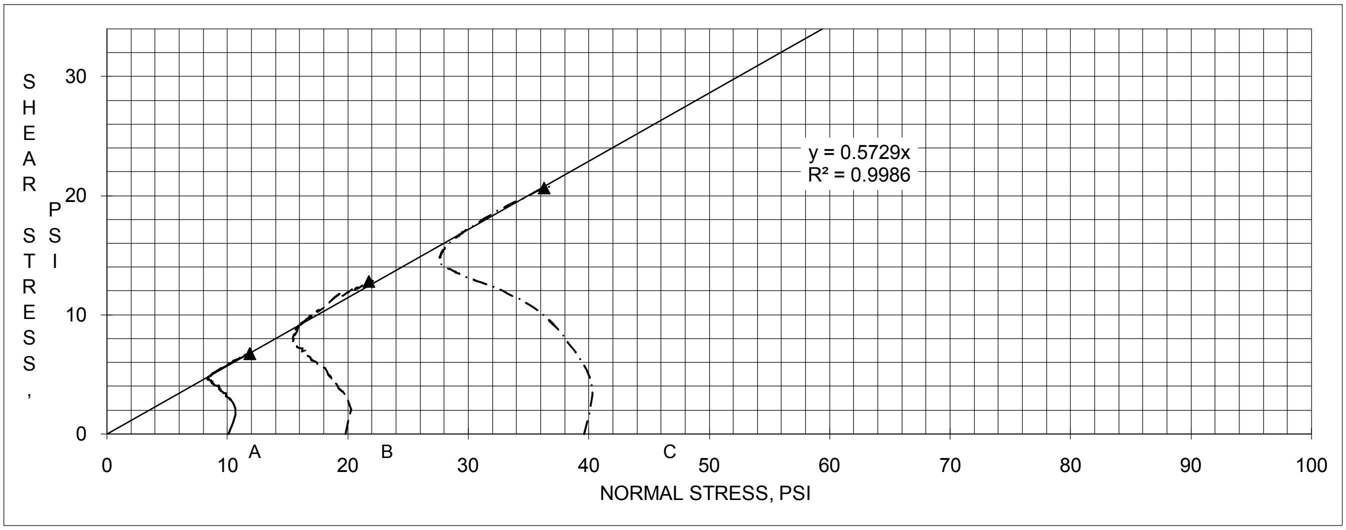
STANDARD PROCTOR = 75pcf @ 25% MOISTURE

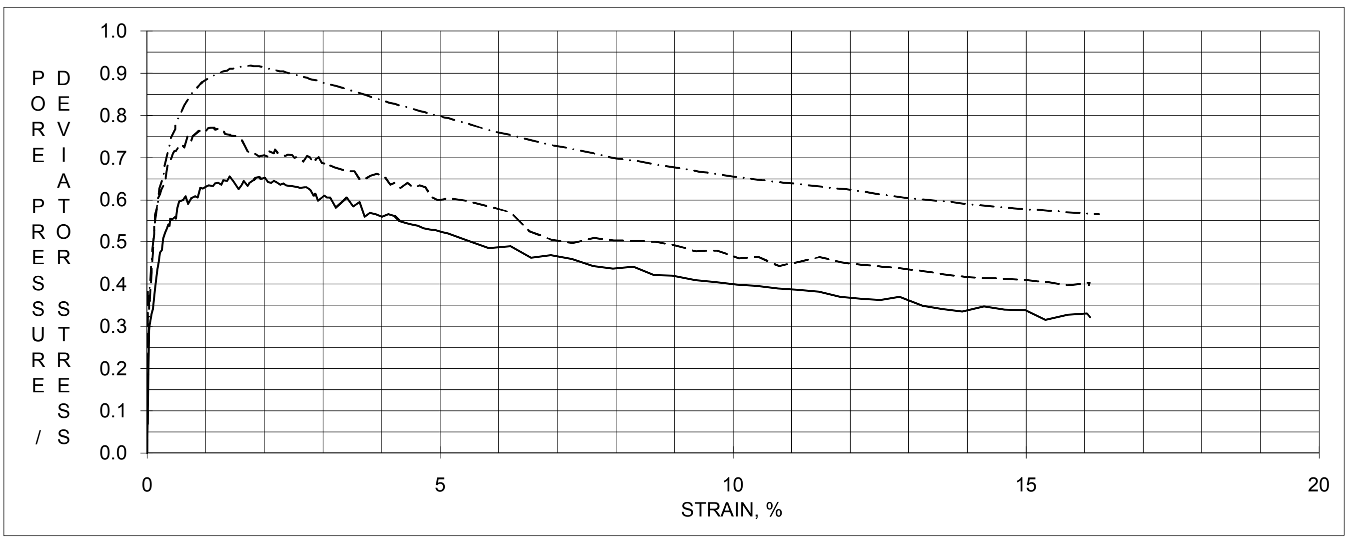
REMOLDED TO 87.9 pcf @ 29.6% MOISTURE REMOLDED TO 117.3% COMPACTION

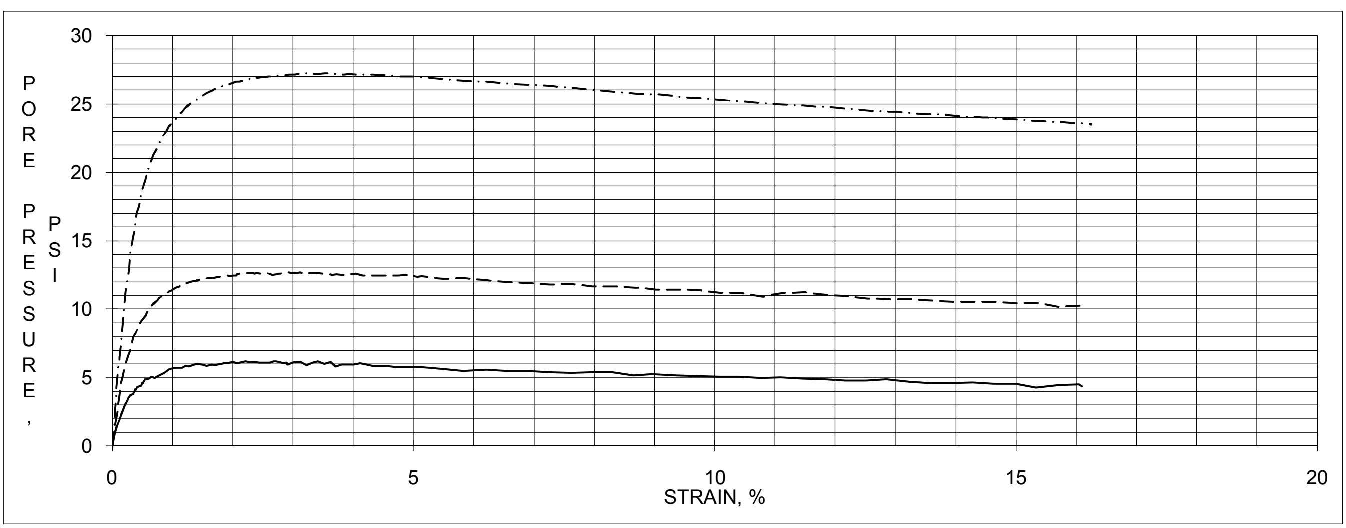
Terracon

MEC RIVERSIDE ASH POND

02105081G B-10 COMPOSITE 13.0 - 18.0







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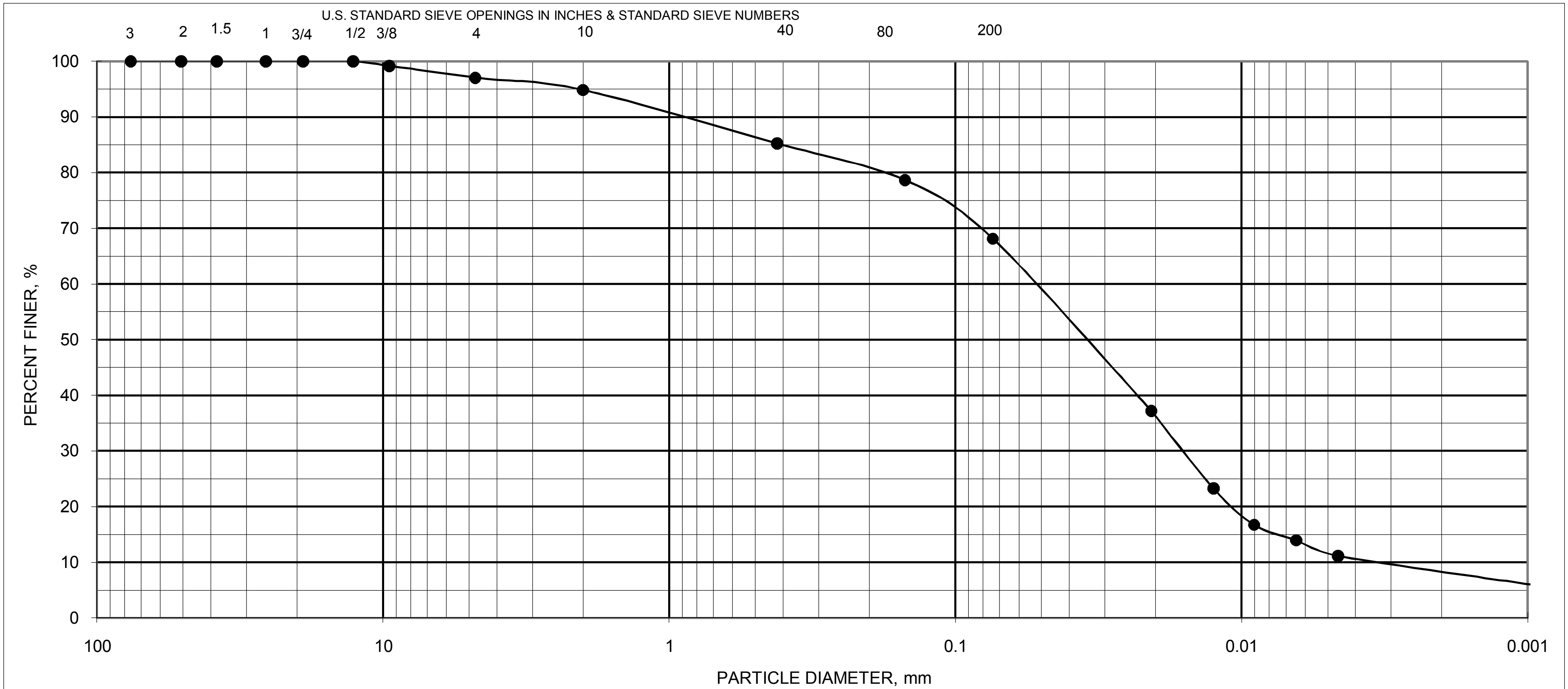

GRAVEL		Sand			Silt or Clay
Coarse	Fine	Coarse	Medium	Fine	

GRAIN SIZE DISTRIBUTION CURVE

BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT. WC, %	ATTERBERG LIMITS LL	PL	PI
B-11	5 and 6	Various	Sandy silt	ML				

PROJECT Riverside Generating Station

Bettendorf, Iowa JOB NO. 07105081 DATE 11/22/2010

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Laboratory Testing

The samples obtained from the borings were tested in our laboratory to determine their water contents. Dry densities were obtained and unconfined compressive strength tests were performed on selected tube samples. A pocket penetrometer was used to help estimate the approximate unconfined compressive strength of some cohesive samples. The pocket penetrometer provides a better estimate of soil consistency than visual examination alone. The laboratory test results are presented on the boring logs.

The soil samples were classified in the laboratory based on visual observation, texture and plasticity. The soil descriptions and estimated group symbols presented on the boring logs for native soils are in general accordance with the Unified Soil Classification System (USCS) and the attached General Notes. A summary of the USCS is also attached.

Atterberg limits and gradation (hydrometer) tests were performed on selected samples to determine index properties and to further classify the materials. A series of isotropically consolidated, undrained triaxial compression tests with pore pressure measurements were preformed on remolded samples to evaluate shear strength properties.

APPENDIX C

SUPPORTING DOCUMENTS

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon – 1-3/8" I.D., 2" O.D., unless otherwise noted H	S:	Hollow Stem Auger
ST:	Thin-Walled Tube - 3" O.D., unless otherwise noted	PA:	Power Auger
RS:	Ring Sampler - 2.42" I.D., 3" O.D., unless otherwise noted	HA:	Hand Auger
DB:	Diamond Bit Coring - 4", N, B	RB:	Rock Bit
BS:	Bulk Sample or Auger Sample	WB:	Wash Boring or Mud Rotary

The number of blows required to advance a standard 2-inch O.D. split-spoon sampler (SS) the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches is considered the “Standard Penetration” or “N-value”.

WATER LEVEL MEASUREMENT SYMBOLS:

WL:	Water Level	WS:	While Sampling	N/E:	Not Encountered
WCI:	Wet Cave in	WD:	While Drilling		
DCI:	Dry Cave in	BCR:	Before Casing Removal		
AB:	After Boring	ACR:	After Casing Removal		

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. Groundwater levels at other times and other locations across the site could vary. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels may not be possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION: Soil classification is based on the Unified Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

CONSISTENCY OF FINE-GRAINED SOILS

Unconfined Compressive Strength, Qu, psf	Standard Penetration or N-value (SS) Blows/Ft.	Consistency
< 500	0-1	Very Soft
500 – 1,000	2-4	Soft
1,001 – 2,000	4-8	Medium Stiff
2,001 – 4,000	8-15	Stiff
4,001 – 8,000	15-30	Very Stiff
8,000+ >	30	Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Standard Penetration or N-value (SS) Blows/Ft.	Ring Sampler (RS) Blows/Ft.	Relative Density
0 – 3	0-6	Very Loose
4 – 9	7-18	Loose
10 – 29	19-58	Medium Dense
30 – 49	59-98	Dense
> 50	> 99	Very Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace	< 15
With	15 – 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75 mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 Sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other Constituents	Percent of Dry Weight
Trace <	5
With 5	– 12
Modifiers >	12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1-10
Medium	11-30
High	> 30

GENERAL NOTES

Sedimentary Rock Classification

DESCRIPTIVE ROCK CLASSIFICATION:

Sedimentary rocks are composed of cemented clay, silt and sand sized particles. The most common minerals are clay, quartz and calcite. Rock composed primarily of calcite is called limestone; rock of sand size grains is called sandstone, and rock of clay and silt size grains is called mudstone or claystone, siltstone, or shale. Modifiers such as shaly, sandy, dolomitic, calcareous, carbonaceous, etc. are used to describe various constituents. Examples: sandy shale; calcareous sandstone.

LIMESTONE	Light to dark colored, crystalline to fine-grained texture, composed of Ca Co_3, reacts readily with HCl.
DOLOMITE	Light to dark colored, crystalline to fine-grained texture, composed of CaMg $(CO_3)_2$, harder than limestone, reacts with HCl when powdered.
CHERT	Light to dark colored, very fine-grained texture, composed of micro-crystalline quartz, $(Si0_2)$, brittle, breaks into angular fragments, will scratch glass.
SHALE	Very fine-grained texture, composed of consolidated silt or clay, bedded in thin layers. The unlaminated equivalent is frequently referred to as siltstone, claystone or mudstone.
SANDSTONE	Usually light colored, coarse to fine texture, composed of cemented sand size grains of quartz, feldspar, etc. Cement usually is silica but may be such minerals as calcite, iron-oxide, or some other carbonate.
CONGLOMERATE	Rounded rock fragments of variable mineralogy varying in size from near sand to boulder size but usually pebble to cobble size (½ inch to 6 inches). Cemented together with various cementing agents. Breccia is similar but composed of angular, fractured rock particles cemented together.

DEGREE OF WEATHERING:

SLIGHT	Slight decomposition of parent material on joints. May be color change.
MODERATE	Some decomposition and color change throughout.
HIGH	Rock highly decomposed, may be extremely broken.

Classification of rock materials has been estimated from disturbed samples.
Core samples and petrographic analysis may reveal other rock types.

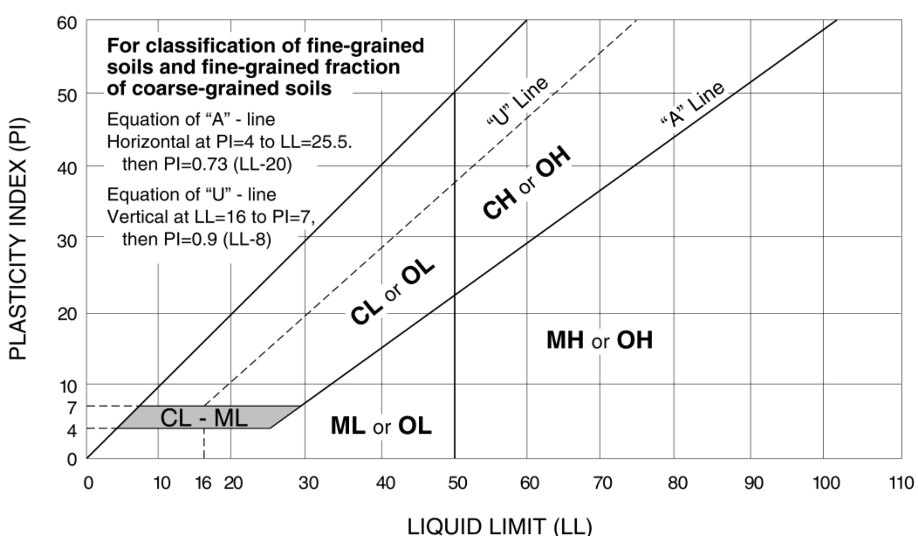
UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			$PI < 4$ or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] $PI \geq 4$ and plots on or above "A" line.
[O] $PI < 4$ or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



References

Bergeson, K. L., Singh, S. and Levorson, S. M., "Evaluation of Riverside Bottom Ash for Utilization as Fill and Base Materials," Final Report, submitted to Iowa-Illinois Gas and Electric Company Research Program, ISU-ERI-Ames 92-407, June, 1992.

EC 1110-2-6067, "USACE Process for the National Flood Insurance Program (NFIP) Levee System Evaluation," U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

EM 1110-2-1901. "Seepage Analysis and Control for Dams," U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS.

EM 1110-2-1902, "Slope Stability," U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS.

EM 1110-2-1913. "Design and Construction of Levees," U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Stark, T. D., Choi, H. and McCone, S., "Drained Shear Strength Parameters for Analysis of Landslides," ASCE JGGE, Vol. 131, No. 5, May 2005, pp. 575-588.

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hgm
ASSOCIATES INC.
640 FIFTH AVENUE COUNCIL BLUFFS, IOWA
PHONE: (712) 323-0530

DEF drawn
DEF designed
TLS approved
SEPT '10 date

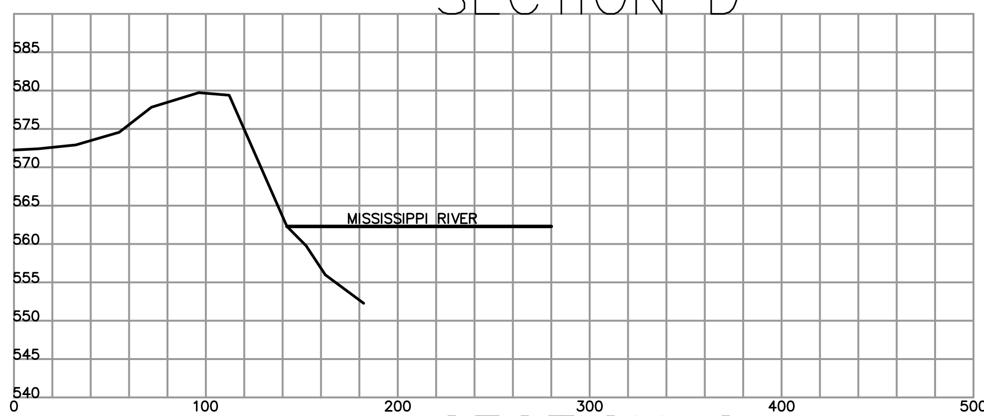
date revision date

project RIVERSIDE IMPOUNDMENT PONDS
BERM STABILITY
client MIDAMERICAN ENERGY COMPANY
7215 NAVAJO STREET, COUNCIL BLUFFS, IOWA 51501
sheet **SOUTH POND SITE PLAN**

project no.
112510
sheet
1 OF 2

fb: hgm: 112510 \\Srv13\data\WSEC\112510-005_MEC Riverside\dwg\112510-5_Riverside.dwg

SECTION D



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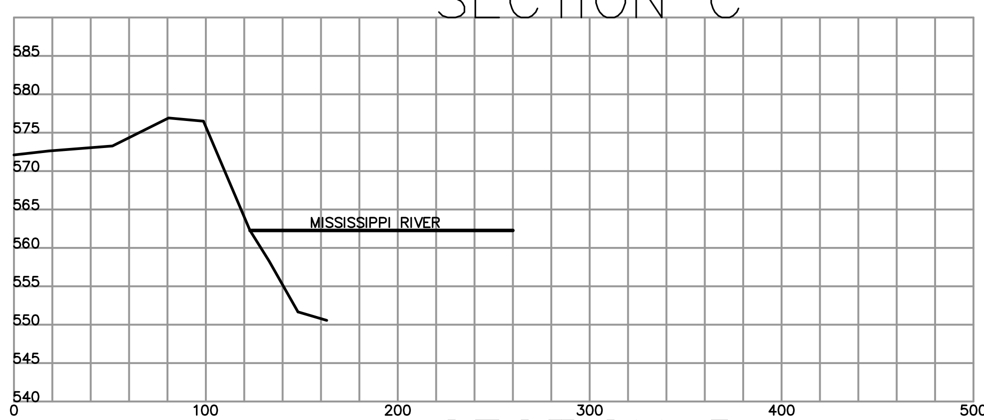

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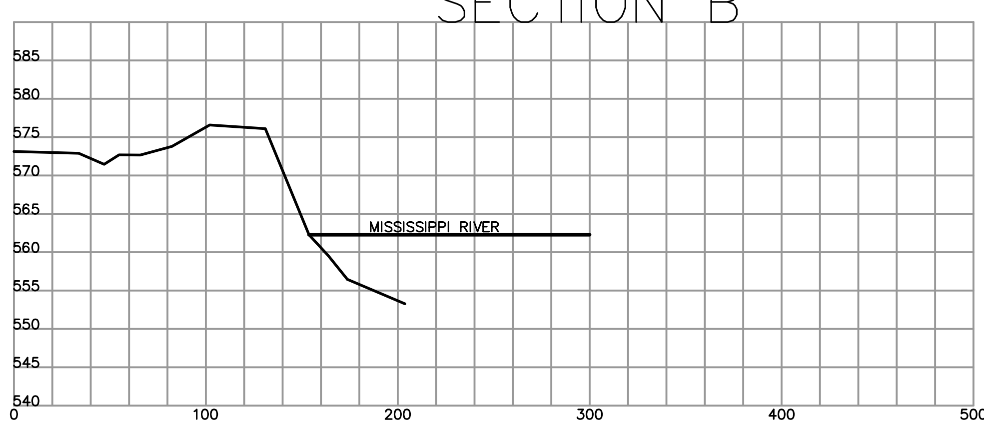

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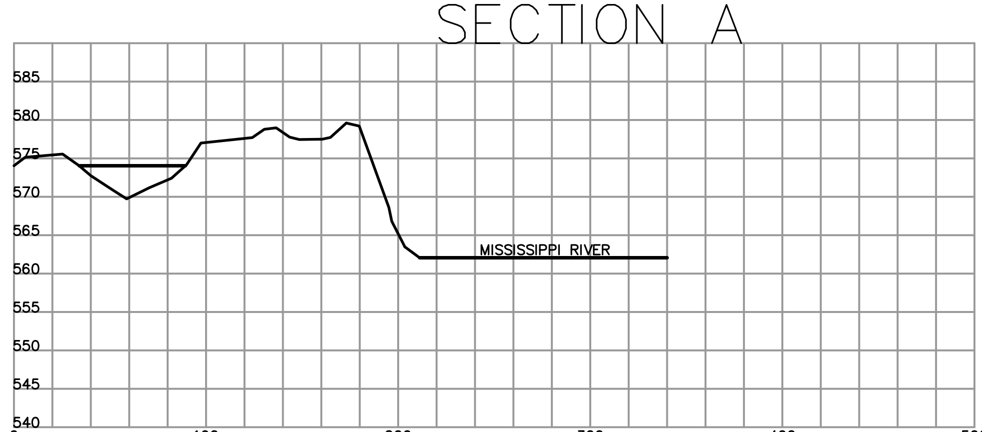
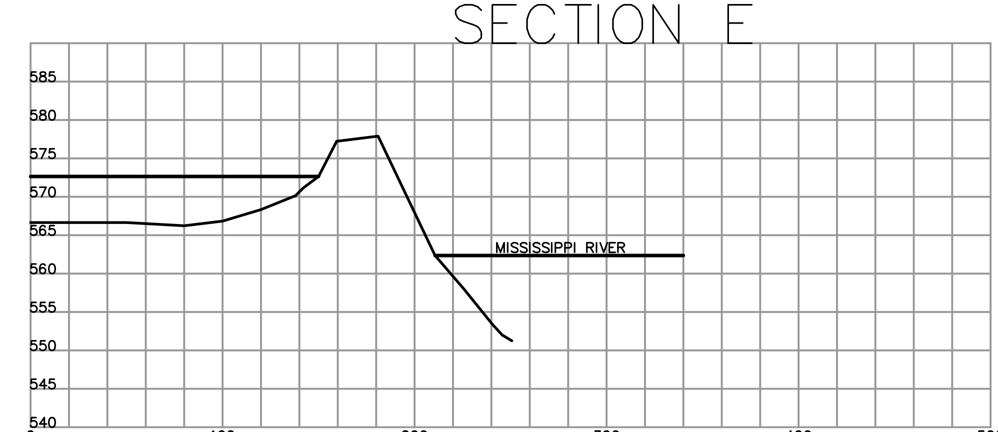


SECTION E



hgm
ASSOCIATES INC.
640 FIFTH AVENUE COUNCIL BLUFFS, IOWA
PHONE: (712) 323-0530

DFF drawn
DFF designed
TLS approved
SEPT '10 date

revision | date

project RIVERSIDE IMPOUNDMENT PONDS
BERM STABILITY
client MIDAMERICAN ENERGY COMPANY
7215 NAVAJO STREET, COUNCIL BLUFFS, IOWA 51501
sheet **SOUTH POND CROSS SECTIONS**

project no.
112510
sheet
2 OF 2

Exhibit C-6

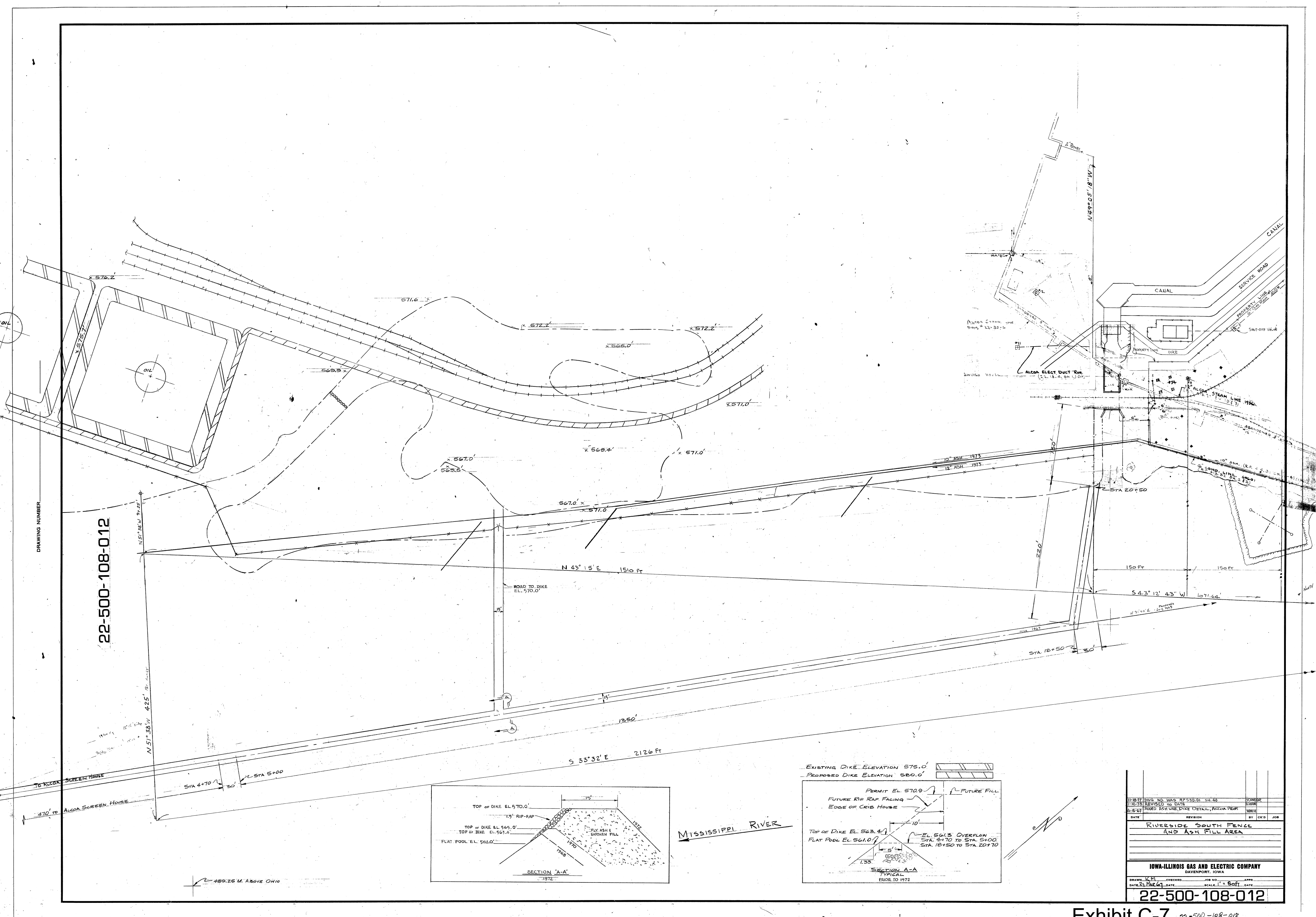


Exhibit C-7 22-500-108-012

MIDAMERICAN ENERGY COMPANY
RIVERSIDE GENERATING STATION
BETTENDORF, IOWA

REMEDIATION OF DIKE EROSION

DWG NO.	DRAWING INDEX TITLE	REV NO.
1	COVER SHEET	0
10	PLAN VIEW	0
20	TYPICAL CROSS SECTIONS	1
30	DETAILS OF PROPOSED CONSTRUCTION	1 ~~0~~

I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF IOWA

Paul H. Schwartz 9/4/01

PAUL H. SCHWARTZ, P.E. IOWA REGISTRATION NO. 11182

MY REGISTRATION EXPIRES DECEMBER 31, 2002

PAGES OR DRAWINGS COVERED BY THIS SEAL
DRAWINGS 1, 10, 20, 30

NO.	DESCRIPTION	DATE	APPROVED

DRAWN VDM
SCALE AS SHOWN
CHECKED VDM
DATE 08/30/01
APPROVED ---

indeco
630 RIVER DRIVE
BETTENDORF, IOWA 52722 (563)359-5451
A SUBSIDIARY OF JOHNSON BROS.

MIDAMERICAN ENERGY COMPANY
RIVERSIDE GENERATING STATION
BETTENDORF, IOWA

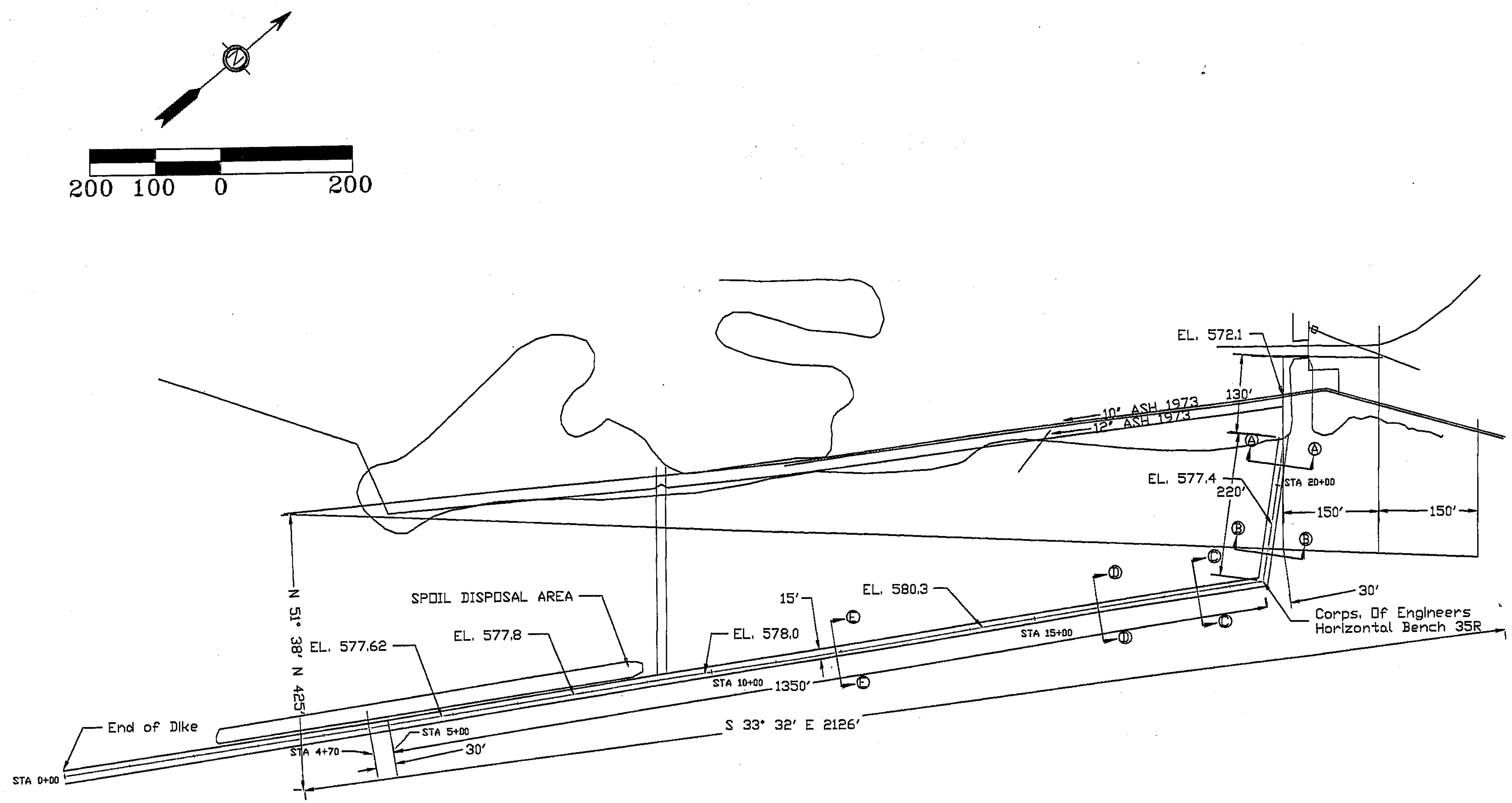
TITLE REMEDIATION OF DIKE EROSION
COVER SHEET

PROJECT NO. 88-14-253.10

DRAWING NO. 1

DWG1.DWG

Exhibit C-8



GENERAL REFERENCES:
1. BASE DRAWING INFORMATION USED FOR SITE MAP OBTAINED FROM MID AMERICAN ENERGY COMPANY DRAWING ENTITLED "RIVERSIDE SOUTH FENCE AND ASH FILL AREA," DRAWN BY IOWA GAS AND ELECTRIC COMPANY, DRAWING NUMBER 22-500-108-012, DATED 27 MARCH 1967 AND LAST REVISED 18 NOVEMBER 1977.

NOTES:
1. DATES OF SURVEY - 28 JUNE 2001, 21 AUGUST 2001
2. STATIONING SHOWN ON PLAN VIEW IS NOT STAKED IN THE FIELD
3. FOR SECTIONS SEE DRAWINGS 20 AND 30

NO.	DESCRIPTION	DATE	APPROVED
1	ADDED STATIONING, REVISED NOTES	8/30/01	WDM

DRAWN TBL | SCALE AS SHOWN
CHECKED GTB | DATE 7/25/01
APPROVED ---

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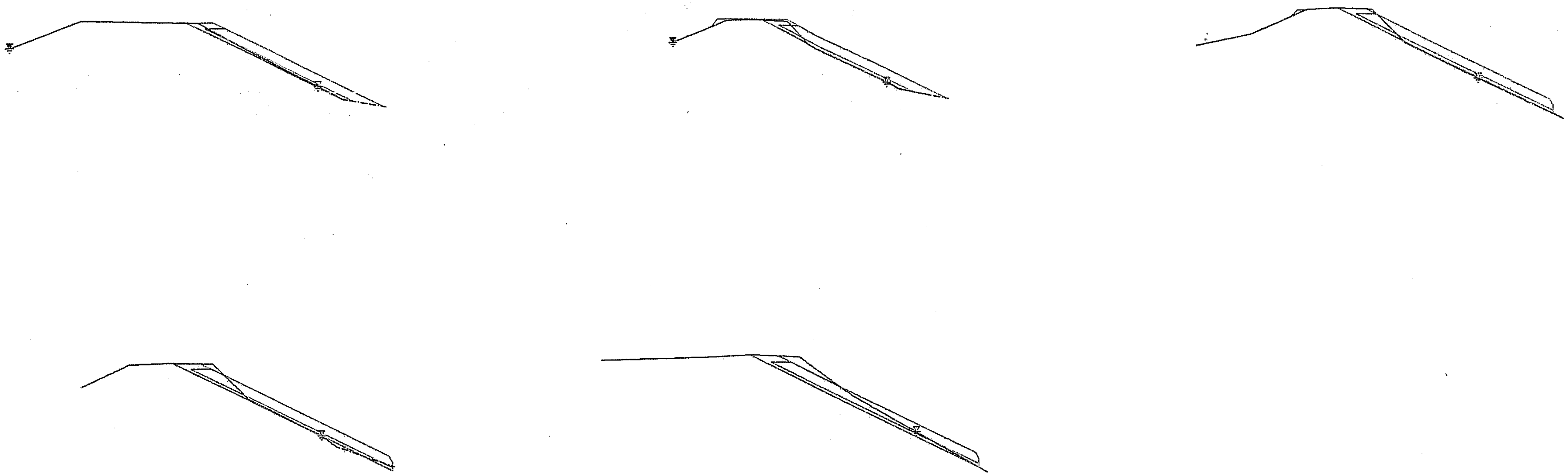
RIVERSIDE GENERATING STATION
BETTENDORF, IOWA
TITLE REMEDIATION OF DIKE EROSION PLAN VIEW

PROJECT NO. 88-14-25310
DRAWING NO. 10

DWG10.DWG

Exhibit C-9



LEGEND

- POND ELEVATION
- RIVER ELEVATION 567 FT. AT TIME OF SURVEY (6/28/2001)

- PROJECTED PROFILE
- EXISTING PROFILE
- DESIGN PROFILE

NOTES:
1. FLAT POOL ELEVATION 561 FT MSL
2. FOR DETAILS OF DESIGN PROFILE SEE DRAWING 30

NO.	DESCRIPTION	DATE	APPROVED
1	ADJUSTED TRAVERSE	8/30/01	WDM
	REVISED SECTIONS FOR ADDL SURVEY	8/29/01	WDM
	REVISED NOTES,REMOVED TYP SECTION	8/29/01	WDM

DRAWN TBL	SCALE AS SHOWN	
CHECKED GTB	DATE 08/03/01	
APPROVED ---		

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MIDAMERICAN ENERGY COMPANY
RIVERSIDE GENERATING STATION
BETTENDORF, IOWA

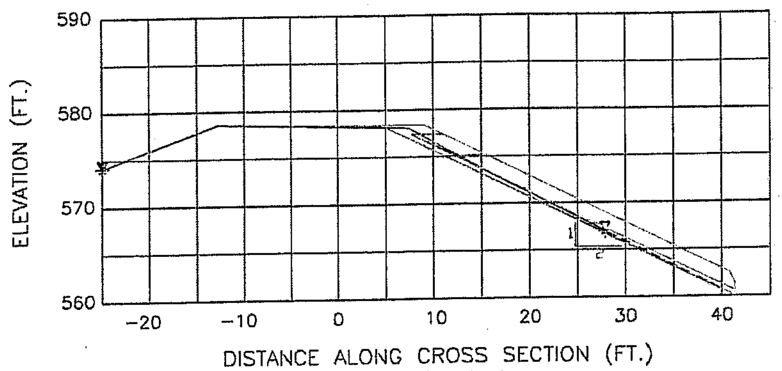
TITLE REMEDIATION OF DIKE EROSION
TYPICAL CROSS SECTIONS

PROJECT NO. 88-14-253.10

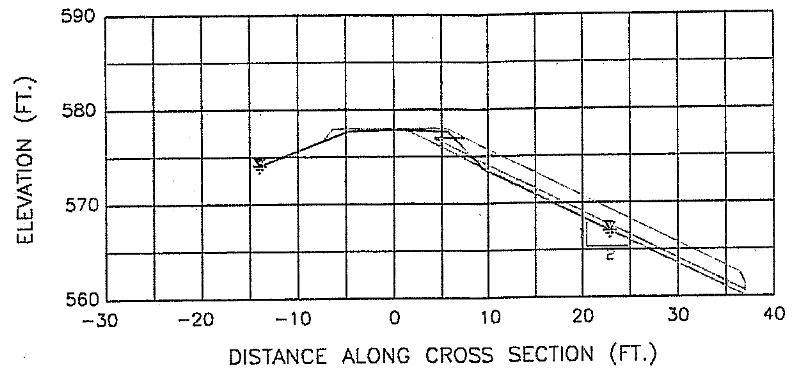
DRAWING NO. 20

Exhibit C-10

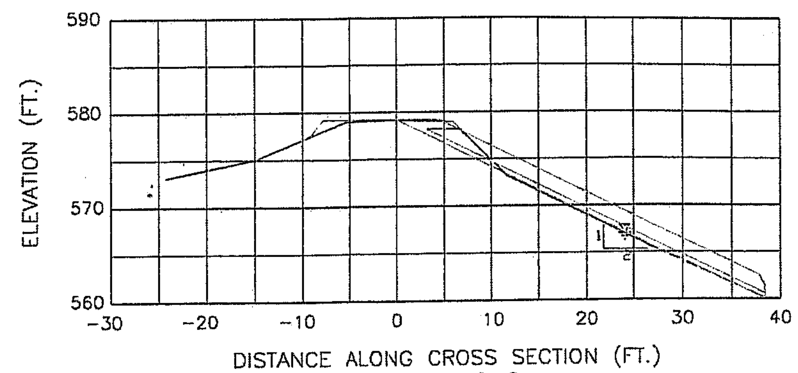
DWG20.DWG



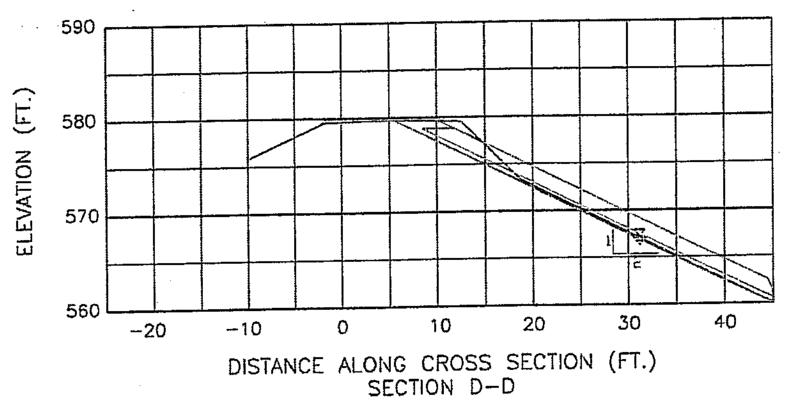
SECTION A-A



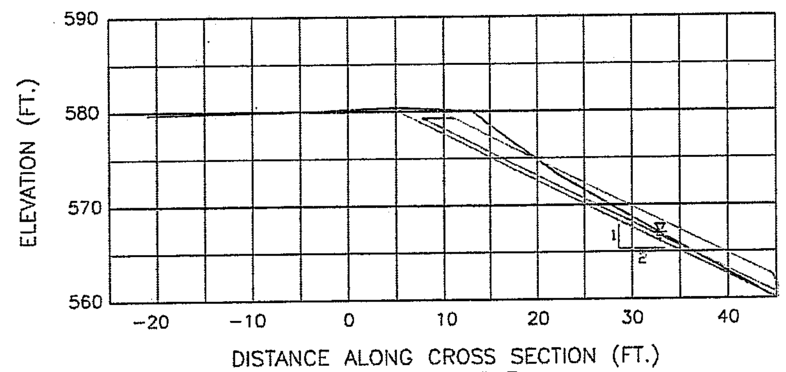
SECTION B-B



SECTION C-C

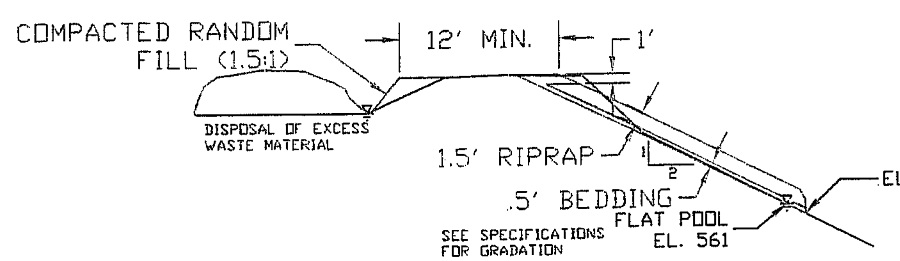


SECTION D-D



SECTION E-E

TYPICAL PROPOSED SECTION



20 Vert

2
1

LEGEND

- POND ELEVATION
- RIVER ELEVATION 567 FT. AT TIME OF SURVEY
- PROJECTED PROFILE
- EXISTING PROFILE

NOTES:
CROSS SECTION ASUMED TO EXTEND ON 2:1 SLOPE BELOW EL. 567

FLAT POOL ELEVATION 561 FT.

NO.	DESCRIPTION	DATE	APPROVED

DRAWN TBL | SCALE AS SHOWN | CHECKED GTB | DATE 08/03/01 | APPROVED ---

indeco
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MID AMERICAN ENERGY COMPANY
RIVERSIDE GENERATING STATION
BETTENDORF, IOWA

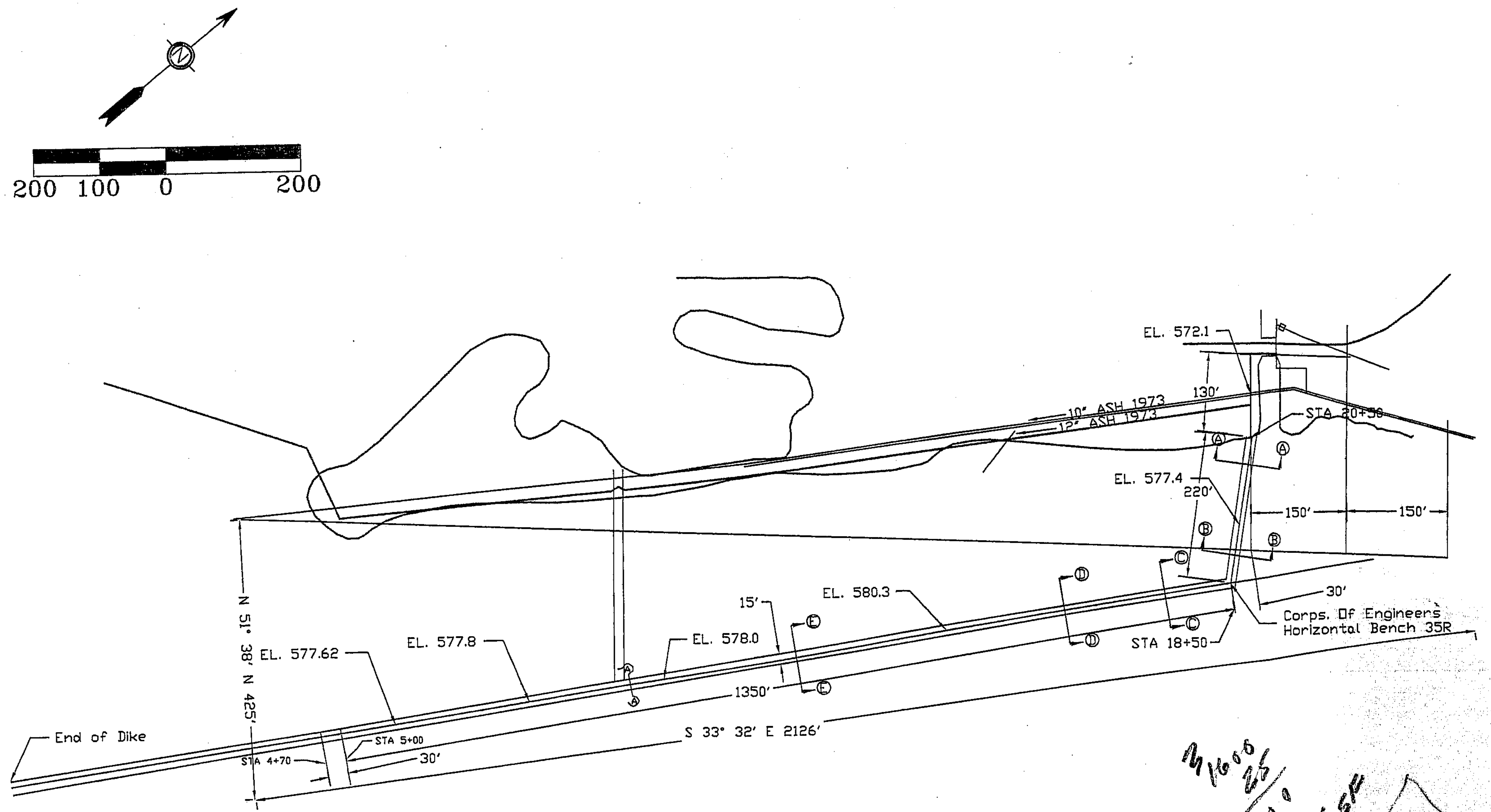
TITLE REMEDIATION OF DIKE EROSION
TYPICAL CROSS SECTIONS

PROJECT NO. 88-14-253.20

DRAWING NO. 20

DWG20.DWG

Exhibit C-11



GENERAL REFERENCES:
1. BASE DRAWING INFORMATION USED FOR SITE MAP OBTAINED FROM MID AMERICAN ENERGY COMPANY DRAWING ENTITLED 'RIVERSIDE SOUTH FENCE AND ASH FILL AREA,' DRAWN BY IOWA GAS AND ELECTRIC COMPANY, DRAWING NUMBER 22-500-108-012, DATED 27 MARCH 1967 AND LAST REVISED 18 NOVEMBER 1977.

NOTES:
1. DATE OF SURVEY - 28 JUNE 2001
2. DATUM - USCOE BENCHMARK
   ASSUMED EL. 580.0

NO.	DESCRIPTION	DATE	APPROVED

DRAWN TBL | CHECKED GTB | APPROVED --- | SCALE AS SHOWN | DATE 7/25/01

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BETTENDORF, IOWA 52722 (563)359-5451
A SUBSIDIARY OF JOHNSON BROS.

MID AMERICAN ENERY COMPANY
RIVERSIDE GENERATING STATION
BETTENDORF, IOWA

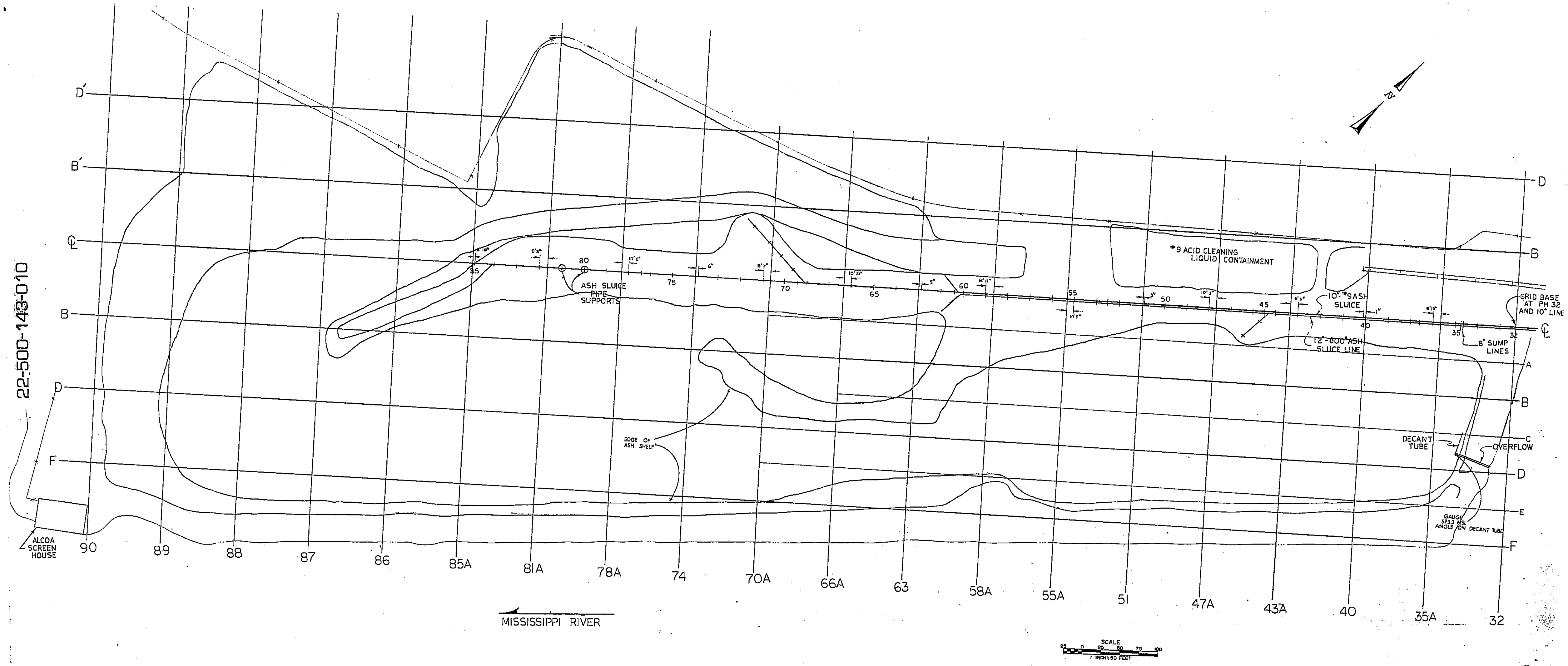
TITLE REMEDIATION OF DIKE EROSION
PLAN VIEW

PROJECT NO. 88-14-253.10

DRAWING NO. 10

DWG10.DWG

Exhibit C-12

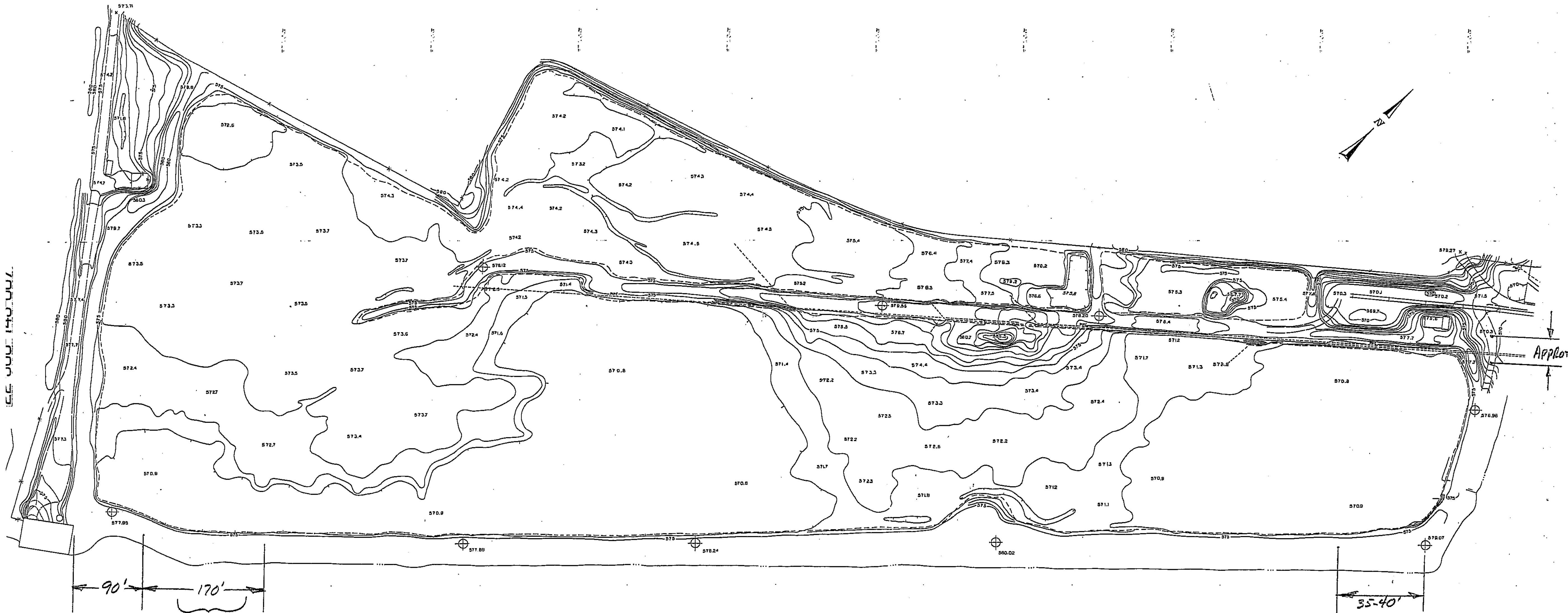


NOTES:
GRID LINES ON 100′ CENTERS

B	11-2001	Rem Acid Hsc	CS	BP
A	8-28-79	GENERAL	BEG	TWB
REV LTR	DATE	REVISION	BY	CK'D

RIVERSIDE ACTIVE ASH POND
LAYOUT AND GRID SYSTEM
IOWA-ILLINOIS GAS & ELECTRIC CO.
DRAWN BEG CK'D ____ SCALE 1"=50′
DATE 6-18-79 DATE ____
DWG. NO. 22-500-143-010

Exhibit C-13



DRILLED & PUMPED 13 HOLES IN THIS AREA (6 PRIMARY, 4 SECONDARY, & 3 TERTIARY) [See INDECO DRAWING FOR DETAILS]

DRILLED & PUMPED 18 HOLES ON 10' ₵ AND TWO SECONDARY HOLES IN THIS AREA. (See INDECO DRAWING FOR DETAILS)

APPROXIMATE AREA WHERE VOID APPEARED DURING REPAIR OF DIKE FACE. AREA WAS NOT PUMPED AT THIS TIME.

TOPOGRAPHIC SURVEY

PREPARED BY

TRI-STATE AERO ENGINEERING

SCALE 25 0 25 50 75 100
1 INCH = 50 FEET

CONTOUR INTERVAL 1 FOOT
ELEVATIONS BASED ON ARBITRARY DATUM

COMPILED BY STEREOPHOTOGRAMMETRIC METHOD FROM AERIAL PHOTOGRAPHY
DATE OF PHOTOGRAPHY 1977

SURFACED ROAD OR STREET
UNSURFACED ROAD OR STREET
TRAIL
RAILROAD
BUILDINGS
TIMBER
STREAM
SWAMP OR MARSH
FENCE
UTILITY POLES
PIPE
MANHOLE
FIRE HYDRANT — F.H.
BRIDGE
CULVERT
CATCH BASIN
CULTIVATION LINE
BENCH MARK — × BM
CHECKED ELEVATION — ×210.3
UNCHECKED ELEVATION — 212
HORIZONTAL CONTROL POINT
SECTION CORNER
MAIL BOX — MB

DATE	REVISION	BY	CK'D	REV. LETTER
6-6-79		BEG		B

DWG. NO. 22-500-143-007

Exhibit C-14

Riverside Generating Station (22)

ESTIMATE SHEET

IOWA-ILLINOIS GAS AND ELECTRIC COMPANY

P. E. No.

Order No.

Account No.

Budget Page Item

Estimated by John W. Griffin Date August 5, 1963

Approved by Date

Proposed to: Provide a new ash disposal area in the Mississippi River behind ALCOA and adjacent to our present disposal area by constructing a riprap dike from Riverside Station to the ALCOA screen house.

Reason: It is estimated that our present ash disposal area will be filled during the summer of 1966. Proposed area is estimated to last until the summer of 1980. The above estimates are based on 50% coal fuel of total fuel, with an annual growth factor of ash production of 1.064.

Quantity	Item	Material	Labor	Total
1 Lot	Rock riprap 13,159 cu. yards @ $4.00 cu.yd. placed	52636		52636
	~~Land Aquisition~~	~~2811~~		~~2811~~
	Permit from U.S. Corps of Engineers		250	250
	Engineering & Supervision		1000	1000
	Overhead		194	194
	G&A	2293	52	2345
	TOTAL	57740	1496	59236
				− 2811
				56425
	Job No. 1013-22			

Exhibit C-15

Form C. O.-28

IOWA-ILLINOIS GAS AND ELECTRIC COMPANY

Ash Disposal Area Dike

SHEET NO. ______ OF ______
DATE 6/6/67 BY R.H.

FORM CO-9L 50M

	BASE BID	PER CU YD OF DIKE IN PLACE ±	COMPLETION	BID BOND	QUARRY ROCK ON BARGES PER CU. YD.	REMARKS
MASSMAN CONST. CO.	62,500.00	5.20	JULY 15	YES		QUESTION OF ROCK TO BE USED
McCARTHY IMPROVEMENT CO.	70,000.00	4.00	OCT. 14	NO		
LECLAIRE QUARRIES					2.00	VERBAL BY PHONE
LEE OSBORN	$96,000					VERBAL BY PHONE @ 24000 yds @ 3000#/yd × $6.00 6/5/66
ESTIMATE	12,233 YDS OR 17,100 TONS @ $2.53/Ton $43,000					

Exhibit C-16

DESIGNED BY	ADAM NEWMAN	
DRAWN BY	NORA DAY	
CHECKED BY	ADAM NEWMAN	
APPROVED BY	KEVIN ARMSTRONG	
PROJECT MANAGER	KEVIN ARMSTRONG	

0 300 600
SCALE IN FEET

MANAGING OFFICE: DES MOINES, IOWA

PROJECT: MIDAMERICAN ENERGY COMPANY
RIVERSIDE GENERATING STATION
BETTENDORF, IOWA

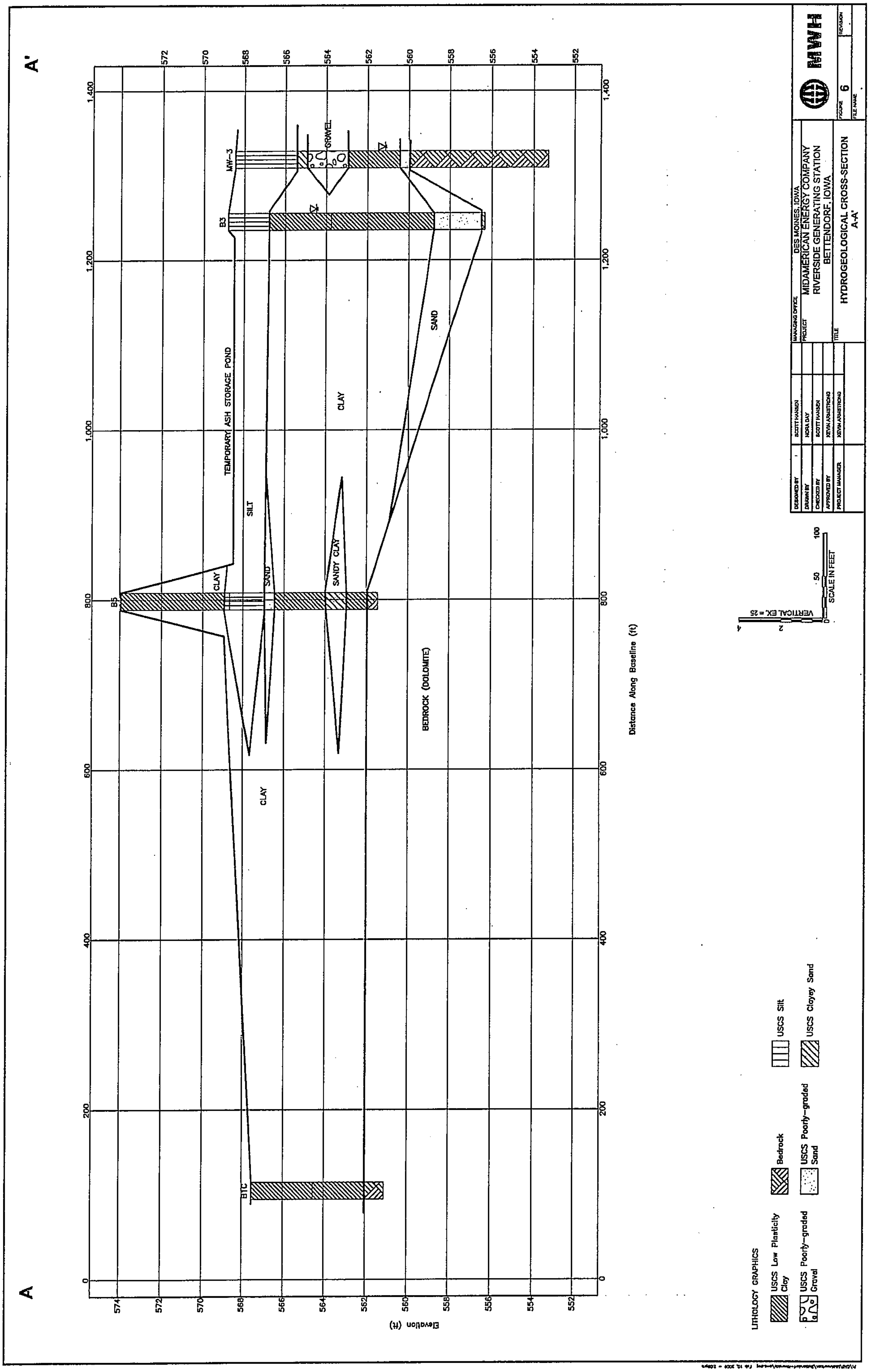
TITLE: **HYDROGEOLOGIC CROSS-SECTION MAP**

MWH

FIGURE 5 REVISION

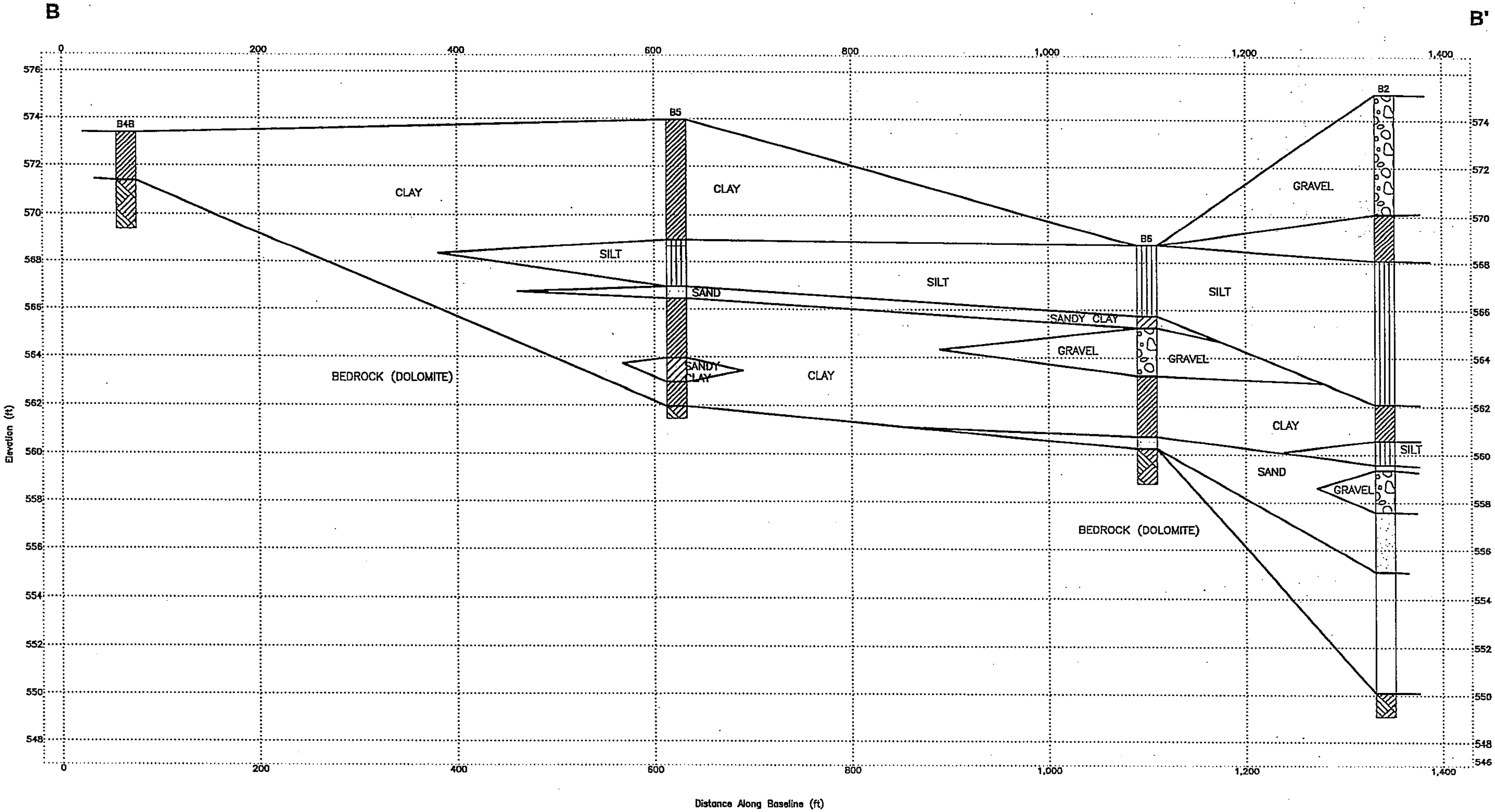
FILE NAME

Exhibit C-17



A
A'
Elevation (ft)
574
572
570
568
566
564
562
560
558
556
554
552
0
200
400
600
800
1,000
1,200
1,400
Distance Along Baseline (ft)
BTC
B5
B3
MW-3
TEMPORARY ASH STORAGE POND
CLAY
SILT
SAND
SANDY CLAY
GRAVEL
BEDROCK (DOLOMITE)
LITHOLOGY GRAPHICS
USCS Low Plasticity Clay
USCS Poorly-graded Gravel
Bedrock
USCS Poorly-graded Sand
USCS Silt
USCS Clayey Sand
VERTICAL EX. = 25
0 50 100
SCALE IN FEET
MWH
MANAGING OFFICE DES MOINES, IOWA
PROJECT MIDAMERICAN ENERGY COMPANY
RIVERSIDE GENERATING STATION
BETTENDORF, IOWA
TITLE HYDROGEOLOGICAL CROSS-SECTION A-A'
DESIGNED BY SCOTT HANSEN
DRAWN BY NORA DAY
CHECKED BY SCOTT HANSEN
APPROVED BY KEVIN ARMSTRONG
PROJECT MANAGER KEVIN ARMSTRONG
FIGURE 6

Exhibit C-18



LITHOLOGY GRAPHICS

- USCS Poorly-graded Gravel
- USCS Clayey Sand
- USCS Low Plasticity Clay
- USCS Poorly-graded Sand
- USCS Silt
- Bedrock

VERTICAL EX. = 25

SCALE IN FEET (0, 50, 100)

DESIGNED BY	SCOTT HANSEN
DRAWN BY	NORA DAY
CHECKED BY	SCOTT HANSEN
APPROVED BY	KEVIN ARMSTRONG
PROJECT MANAGER	KEVIN ARMSTRONG

MANAGING OFFICE: DES MOINES, IOWA

PROJECT: MIDAMERICAN ENERGY COMPANY RIVERSIDE GENERATING STATION BETTENDORF, IOWA

TITLE: HYDROGEOLOGICAL CROSS-SECTION B-B'

MWH

FIGURE 7

REVISION

FILE NAME

Exhibit C-19

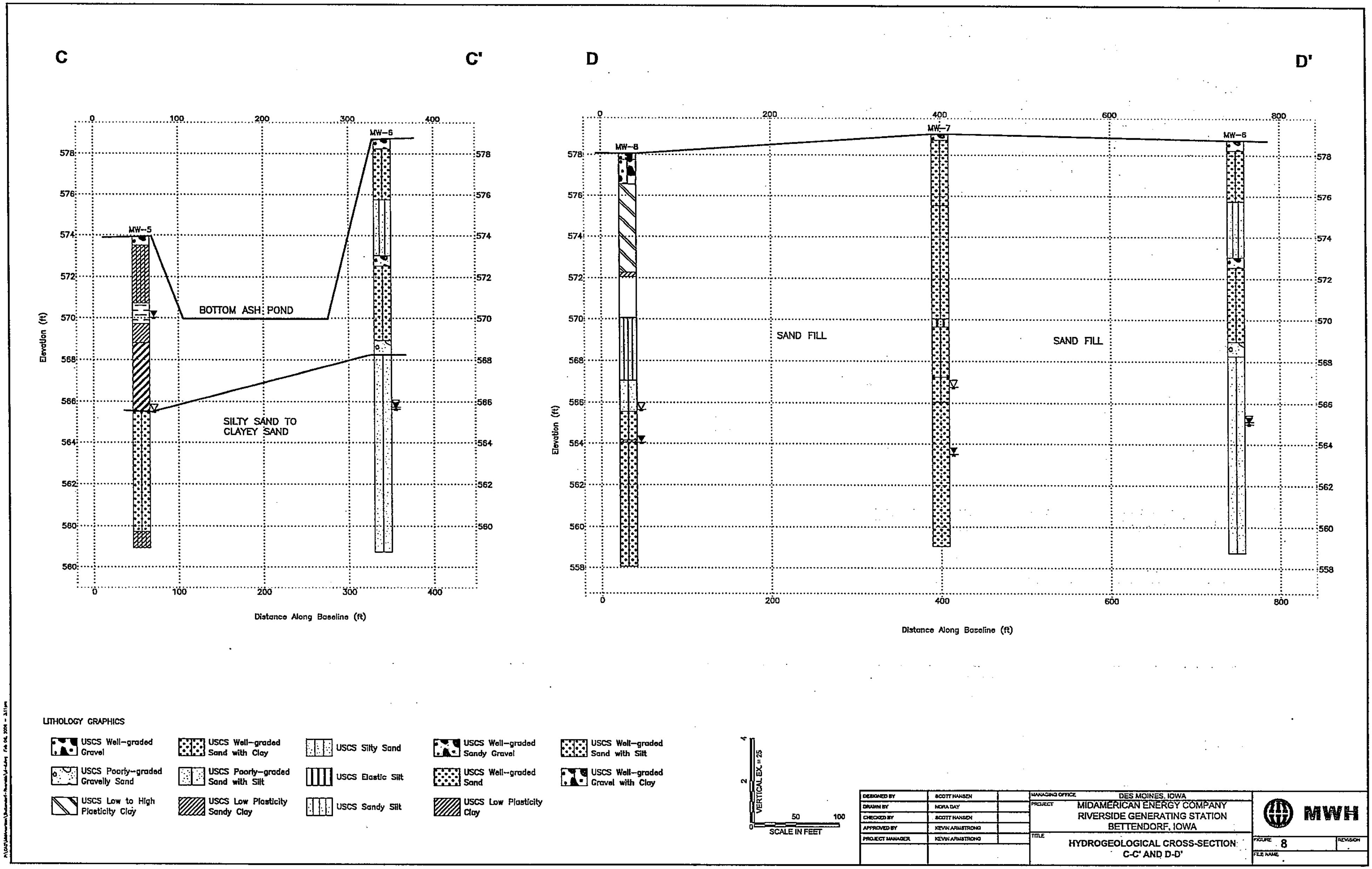

C
C'
D
D'
BOTTOM ASH POND
SILTY SAND TO CLAYEY SAND
SAND FILL
SAND FILL
MW-5
MW-6
MW-8
MW-7
MW-6
Elevation (ft)
Distance Along Baseline (ft)
LITHOLOGY GRAPHICS
USCS Well-graded Gravel
USCS Poorly-graded Gravelly Sand
USCS Low to High Plasticity Clay
USCS Well-graded Sand with Clay
USCS Poorly-graded Sand with Silt
USCS Low Plasticity Sandy Clay
USCS Silty Sand
USCS Elastic Silt
USCS Sandy Silt
USCS Well-graded Sandy Gravel
USCS Well-graded Sand
USCS Low Plasticity Clay
USCS Well-graded Sand with Silt
USCS Well-graded Gravel with Clay
VERTICAL EX. = 25
SCALE IN FEET
DESIGNED BY SCOTT HANSEN
DRAWN BY NORA DAY
CHECKED BY SCOTT HANSEN
APPROVED BY KEVIN ARMSTRONG
PROJECT MANAGER KEVIN ARMSTRONG
MANAGING OFFICE DES MOINES, IOWA
PROJECT MIDAMERICAN ENERGY COMPANY
RIVERSIDE GENERATING STATION
BETTENDORF, IOWA
TITLE HYDROGEOLOGICAL CROSS-SECTION C-C' AND D-D'
FIGURE 8
REVISION
FILE NAME
MWH

Exhibit C-20

MWH

Drilling Log

Monitoring Well **MW-4**

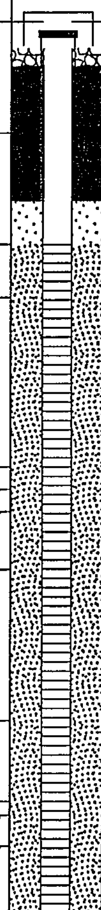
Project	Riverside Generating Station	Owner	MidAmerican Energy Company
Location	6001 State Street, Bettendorf, Iowa	Project Number	1914068.0101
Surface Elev.	574.36 ft	North -356	East 1015
Top of Casing	574.03 ft	Water Level Initial ∇556.53 01/15/08 12:00	Static ▼563.43 01/15/08 13:15
Hole Depth	20.0ft	Screen: Diameter 2 in, Length 15.0 ft	Type/Size PVC/0.01 in
Hole Diameter	8.25 in	Casing: Diameter 2 in, Length 4.7 ft	Type PVC
Drill Co.	Thiele Geotech, Inc.	Drilling Method Hollow Stem Auger/24-inch Split Spoon	Sand Pack NA
Driller	Dave Mather	Driller Reg. # 7892	Log By Adam Newman
Start Date	1/15/2008	Completion Date 1/15/2008	Checked By K. Armstrong

COMMENTS

Legend: Bentonite Grout, Bentonite Granules, Grout, Portland Cement, Sand Pack, Sand Pack

Depth (ft)	PID (ppm)	% Recovery	Blow Count Recovery	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.
					Gravel
0	0.0			GW	Surface - coarse angular GRAVEL (imported) ballast over medium to large gravel with coal dust.
	1.2			CL ML	Silty CLAY, soft, brown, moderate plasticity, low moisture, no odor.
5	0.0	100%	4 5	CL	CLAY, soft, light brown, with black organic silty nodules, low moisture, no odor.
	0.0	100%	4 5 5 7 9 9 0 3	CL ML	Silty CLAY, soft, brown, some fine sand, stiff at 7 feet, dark brown at 7.8 feet, no odor.
10	0.0	100%	4	CL	Fine sandy CLAY, soft, brown, some miosture, no odor.
			6	CL ML	Silty CLAY, soft, dark brown, moist, moderate plasticity, no odor.
	0.0	100%	3 4	CL	Fine sandy CLAY w/ some silt, reddish/light brown, moist, no odor
	0.0	100%	6 7 1 3 4 5 2	CL ML	Silty CLAY, soft, dark grey, moist, some small well-rounded gravel from 14-15.7, no odor.
15	0.0	100%	3 4 4 1	CL	CLAY, soft, light grey; brown silty mottles with trace small-medium sand, moist-wet, no odor.
	0.0	100%	2	MH	Clayey SILT with some fine well rounded gravel, light grey/light brown, wet, no odor.
			2	CL	Fine sandy CLAY, soft, ligth brown/light grey, moist-wet, no odor.
20	0.0	100%	2 3 9 8 14		Weathered BEDROCK, very hard fractured clayey SILT, light grey, wet.
25					

Well Completion



Elevation (ft): 574.36, 570, 565, 560, 555, 550

Drilling Log

MWH

Monitoring Well **MW-5**

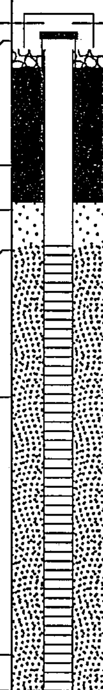
Project: Riverside Generating Station	Owner: MidAmerican Energy Company
Location: 6001 State Street, Bettendorf, Iowa	Project Number: 1914068.0101
Surface Elev.: 573.93 ft	North: -2708 East: -328
Top of Casing: 573.86 ft	Water Level Initial: ∇565.46 01/15/08 15:50 Static: ▼569.96 01/16/08 08:10
Hole Depth: 15.0ft	Screen: Diameter 2 in Length 10.0 ft Type/Size PVC/0.01 in
Hole Diameter: 8.25 in	Casing: Diameter 2 in Length 4.7 ft Type PVC
Drill Co.: Thiele Geotech, Inc.	Drilling Method: Hollow Stem Auger/24-inch Split Spoon Sand Pack: NA
Driller: Dave Mather	Driller Reg. #: 7892 Log By: Adam Newman
Start Date: 1/15/2008	Completion Date: 1/15/2008 Checked By: K. Armstrong

COMMENTS

Legend: Bentonite Grout, Bentonite Granules, Grout, Portland Cement, Sand Pack, Sand Pack

Depth (ft)	PID (ppm)	% Recovery	Blow Count Recovery	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.	Elevation (ft)
					Gravel	573.93
0				GW	Surface - coarse angular GRAVEL (imported).	
				CL	Mottled silty CLAY, soft-stiff, reddish brown, moist, no odor.	
	0.0	100%	3, 3, 10, 8	OL	Organic silty CLAY, small roots, soft, dark brown, moist, no odor.	570
5	0.0	100%	3, 2, 4, 3	CL	Mottled fine sandy CLAY, some small coal fragments, brown/light grey, moist, no odor.	
	0.0	100%	2, 3, 2, 2	CH	CLAY, soft, some small fragments of coal and weathered sandstone, moist-wet, no odor.	
10	0.0	100%	1, 1, 1, 1	SC	Clayey fine SAND with fine subangular gravel, dark brown, wet, no odor.	565
	0.0	100%	0, 0, 6, 1			
15	0.0	100%	1, 1, 1, 2	CL	Silty CLAY, soft to stiff, dark brown, moist-wet, no odor.	560
20						555
25						550

Well Completion



Drilling Log MW-4 TO MW-8.GPJ MWH IA.GDT 2/12/09

Drilling Log

Monitoring Well **MW-6**

Project	Riverside Generating Station
Owner	MidAmerican Energy Company
Location	6001 State Street, Bettendorf, Iowa
Project Number	1914068.0101
Surface Elev.	578.75 ft
North	-2856
East	-84
Top of Casing	578.10 ft
Water Level Initial	∇565.1 (01/16/08 14:30)
Static	▼565 (01/17/08 08:30)
Hole Depth	20.0ft
Screen: Diameter	2 in
Screen: Length	15.0 ft
Screen: Type/Size	PVC/0.01 in
Hole Diameter	8.25 in
Casing: Diameter	2 in
Casing: Length	4.7 ft
Casing: Type	PVC
Drill Co.	Thiele Geotech, Inc.
Drilling Method	Hollow Stem Auger/24-inch Split Spoon NA
Driller	Dave Mather
Driller Reg. #	7892
Log By	Adam Newman
Start Date	1/16/2008
Completion Date	1/16/2008
Checked By	K. Armstrong

COMMENTS

Legend: Bentonite Grout · Bentonite Granules · Grout · Portland Cement · Sand Pack · Sand Pack

Depth (ft)	PID (ppm)	% Recovery	Blow Count Recovery	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.	Elevation (ft)
					Gravel	578.75
0				GW	Surface - coarse angular GRAVEL (imported).	
				SW SC	Clayey fine SAND w/ some fine angular gravel, dark brown, moist-wet, no odor.	
	0.0			SM	Silty fine-coarse SAND, dark brown, moist, no odor.	575
5	0.0	100%	4, 3, 8, 5			
				GW	Coarse GRAVEL, angular/subangular, with dark brown/light brown silty fine/medium sand, moist, no odor.	
	0.0	100%	3, 2, 5, 4	SW SM	Silty fine SAND, dark brown, moist, no odor.	
	0.0	100%	1, 1, 7, 4			570
10				SP	Coarse SAND, light brown, some angular to well rounded fine gravel with small wood fragments, moist, no odor.	
	0.0	100%	1, 3, 1, 2	SP SM	Silty fine SAND, dark brown, coarse angular gravel at 12 feet, some medium angular gravel at 13 - 14.2 feet, some clay at 15.5 - 16 feet, moist, wet at 13 feet, no odor.	
∇▼	0.0	100%	2, 1, 1, 1			565 ∇▼
15	0.0	100%	1, 0, 0, 0			
	0.0	100%	0, 0, 1, 1			560
	0.0	100%	1, 0, 0, 0			
20						
25						555

MWH

Drilling Log

Monitoring Well **MW-7**

Page: 1 of 1

Project: *Riverside Generating Station*	Owner: *MidAmerican Energy Company*
Location: *6001 State Street, Bettendorf, Iowa*	Project Number: *1914068.0101*
Surface Elev. *579.05 ft* North *-3158*	East *-259*
Top of Casing *578.56 ft* Water Level Initial ∇ *566.76* 01/16/08 11:35	Static ▼ *563.51* 01/17/08 09:30
Hole Depth *20.0ft* Screen: Diameter *2 in* Length *15.0 ft*	Type/Size *PVC/0.01 in*
Hole Diameter *8.25 in* Casing: Diameter *2 in* Length *4.7 ft*	Type *PVC*
Drill Co. *Thiele Geotech, Inc.* Drilling Method *Hollow Stem Auger/24-inch split spoon*	Sand Pack *NA*
Driller *Dave Mather* Driller Reg. # *7892*	Log By *Adam Newman*
Start Date *1/16/2008* Completion Date *1/16/2008*	Checked By *K. Armstrong*

COMMENTS

Bentonite Grout | Bentonite Granules | Grout | Portland Cement | Sand Pack | Sand Pack

Depth (ft)	PID (ppm)	% Recovery	Blow Count Recovery	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.	Elevation (ft)
0					Gravel	579.05
				GW	Surface - coarse angular GRAVEL (imported).	
	0.0			SW SC	Clayey fine SAND, dark brown, moist-wet, no odor.	
	1.2					
					Silty fine SAND, dark brown, slightly moist, no odor.	575
5	0.0	100%	4 5 4 5	SW SM		
	0.0	100%	5 7 9 9			570
			0	MH	Clayey SILT, light brown, moist, no odor.	
10	0.0	100%	3 4 6	SW SC	Clayey fine SAND, dark brown, moist-wet, no odor.	
∇	0.0	100%	3 4 6 7	SW SM	Silty fine SAND, dark brown, wet, no odor.	∇
	0.0	100%	1 3 4 5	SW	Fine to medium SAND, brown, trace silt, some small angular fragments of sandstone at 17.5 feet, wet, well drained, no odor.	565
15 ▼	0.0	100%	2 3 4 4			▼
	0.0	100%	1 2 2 2			560
20	0.0	100%	3 9 8 14			
25						555

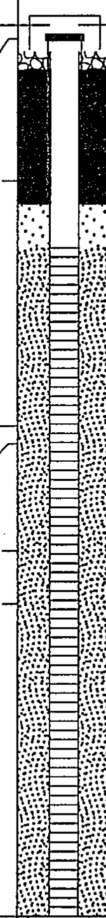


Exhibit C-24

Drilling Log

Monitoring Well MW-8

Project	Riverside Generating Station	Owner	MidAmerican Energy Company
Location	6001 State Street, Bettendorf, Iowa	Project Number	1914068.0101
Surface Elev.	578.06 ft	North -3465	East -462
Top of Casing	577.65 ft	Water Level Initial ∇565.65 01/16/08 09:00	Static ▼564.05 01/17/08 10:10
Hole Depth	20.0ft	Screen: Diameter 2 in, Length 15.0 ft	Type/Size PVC/0.01 in
Hole Diameter	8.25 in	Casing: Diameter 2 in, Length 4.7 ft	Type PVC
Drill Co.	Thiele Geotech, Inc.	Drilling Method Hollow Stem Auger/24-inch Split Spoon	Sand Pack NA
Driller	Dave Mather	Driller Reg. # 7892	Log By Adam Newman
Start Date	1/16/2008	Completion Date 1/16/2008	Checked By K. Armstrong

COMMENTS

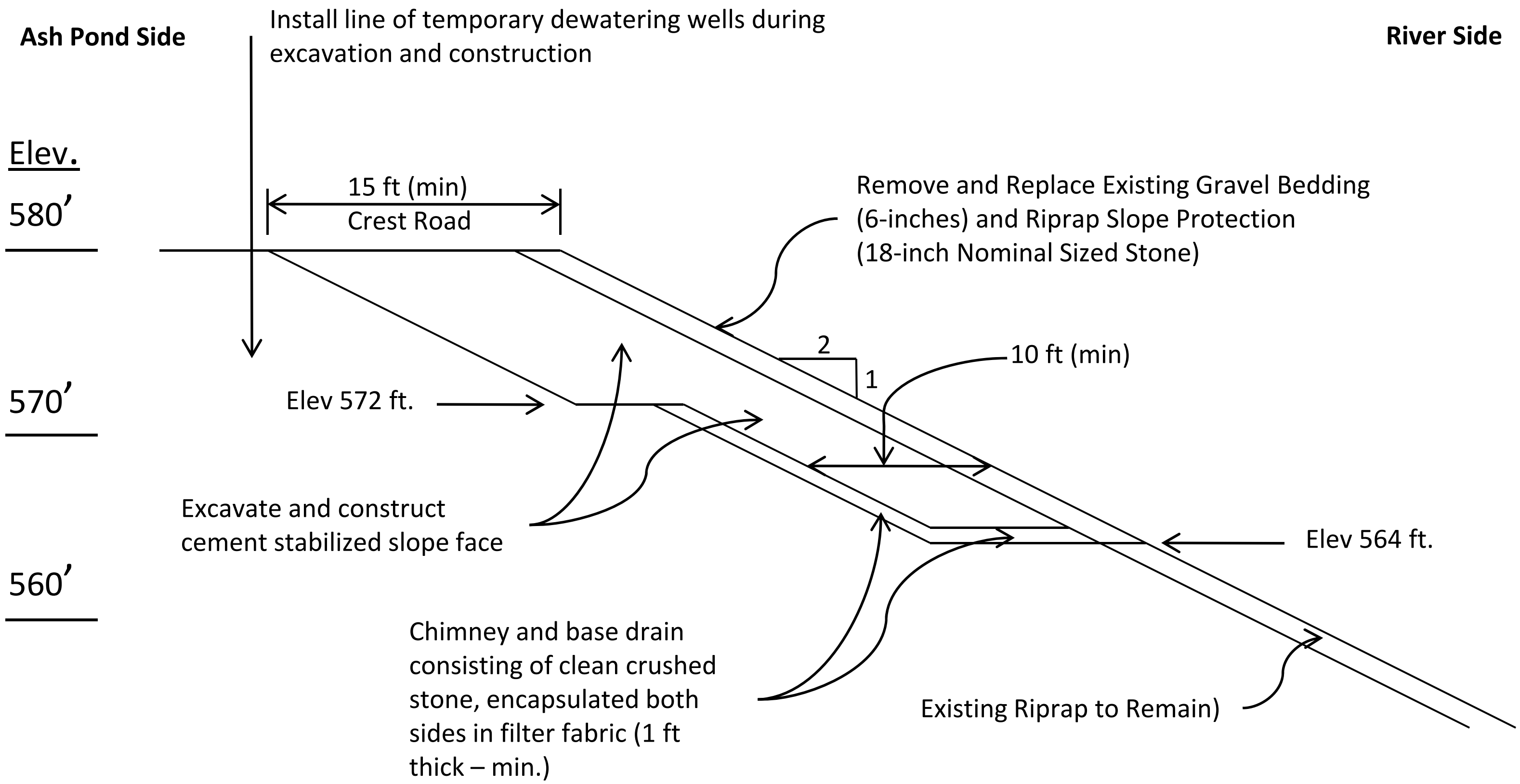
Legend: Bentonite Grout, Bentonite Granules, Grout, Portland Cement, Sand Pack, Sand Pack

Depth (ft)	PID (ppm)	% Recovery	Blow Count Recovery	USCS	Description (Color, Moisture, Texture, Structure, Odor) Geologic Descriptions are Based on the USCS.	Elevation (ft)
0					Gravel	578.06
0				GW	Surface - coarse angular GRAVEL (imported).	
				GW GC	Coarse angular GRAVEL with brown clay, wet, no odor.	
	0.0			CL	CLAY, soft, brown, moderate plasticity, some small angular gravel and fine sand, some moisture, no odor.	575
5	0.0	100%	0 2 2 2			
				CL	Fine sandy CLAY, soft, reddish brown, moist, no odor.	
		0%	1 0 1 0		No recovery.	570
10	0.0	100%	1 0 0 0 0 1	ML	Fine sandy SILT with interbedded reddish brown fine sandy clay, very soft, moist, no odor.	
	0.0	100%	1 1 1	SP SM	Silty fine to coarse SAND, dark brown, wet at 12 feet, no odor.	
∇	0.0		0 1 1	SW SC	Clayey fine SAND, some small fragments of sandstone at 13.8 feet, brown/dark brown, wet, no odor.	565
▼		100%		CL	CLAY, soft, moderate to low plasticity, light brown, moist, no odor.	
15	0.0	100%	4 4 4 8	SW SM	Silty fine SAND, dark brown, wet, no odor.	
	0.0	100%	4 3 2 3			560
20	0.0	100%	3 3 2 7			
						555
25						

Drilling Log MW-4 TO MW-8.GPJ MWH IA.GDT 2/12/09

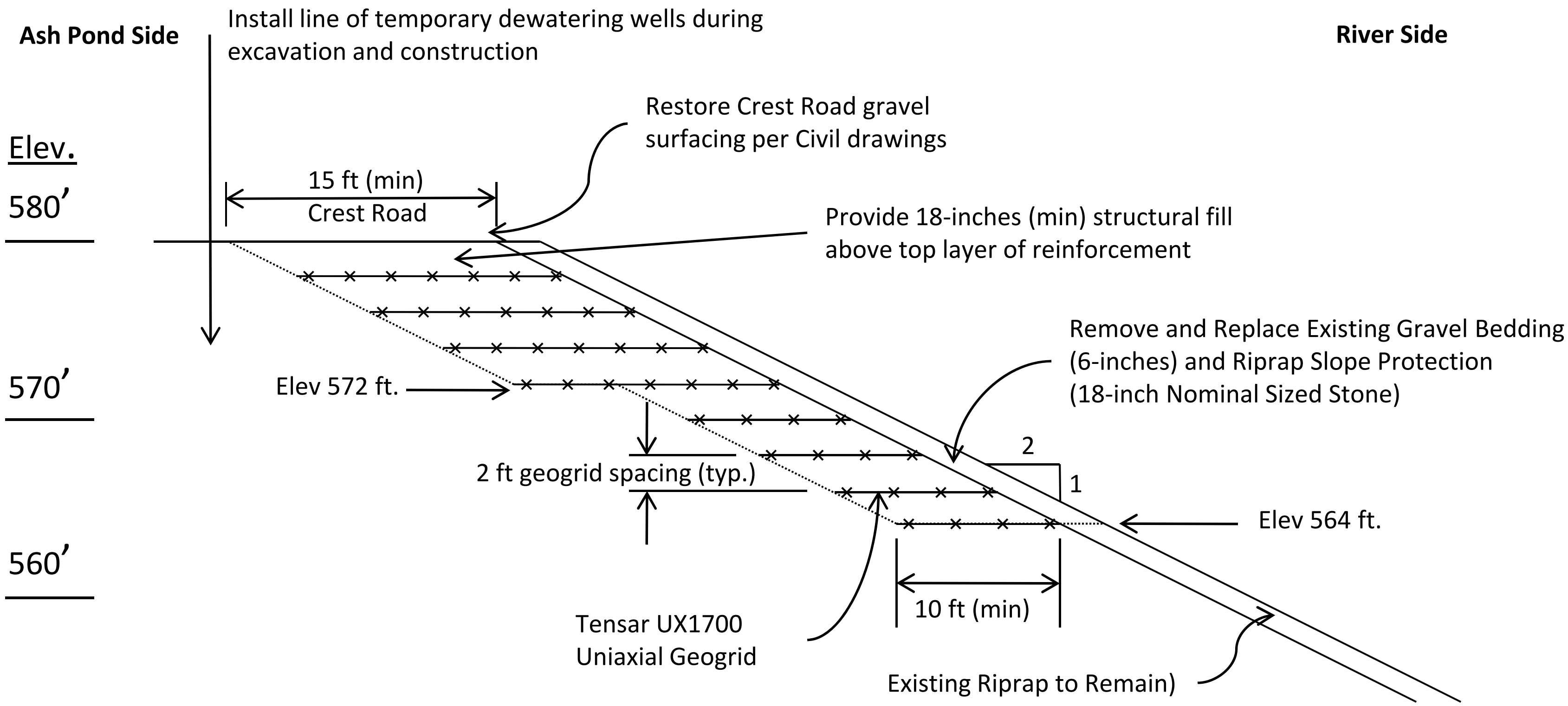
APPENDIX D

Slope Stability Analyses



Ash Pond Embankment Slope - Typical Section
Cement Stabilized Slope Face Remediation Option

EXHIBIT D-1A



<u>Ash Pond Embankment Slope - Typical Section</u>
<u>Geogrid Reinforced – Mechanically Stabilized Slope Face</u>
<u>Remediation Option</u>

EXHIBIT D-1B

Title: Existing Conditions - Steady State Seepage
File Name: SEEPW SECT A Existing (Steady State).gsz
Date: 11/22/2010 By: BWL

Pond Boundary Condition: H = 574.2 feet
River Boundary Condition: H = 561 feet
Pressure head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee

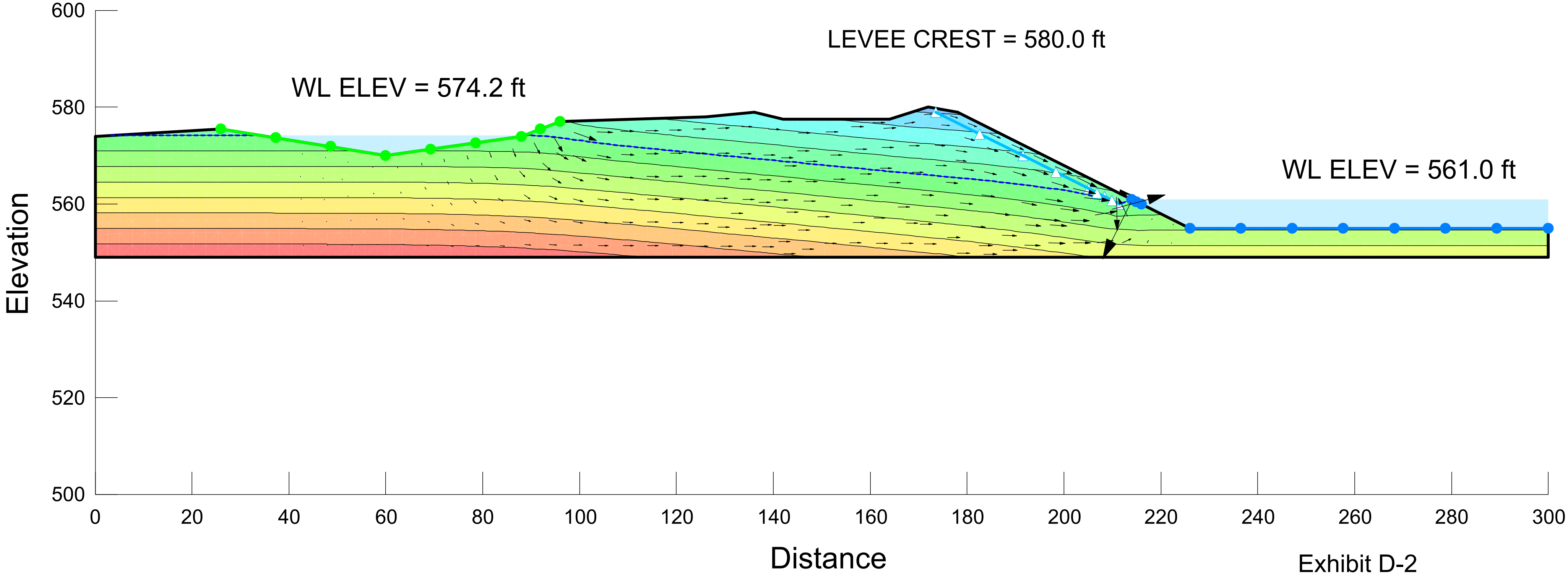


Exhibit D-2

Title: Existing Conditions - Steady State Seepage
File Name: SECT A Existing (Steady State).gsz
Date: 11/22/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Rip Rap Unit Weight: 130 pcf Cohesion: 0 psf Phi: 38 °

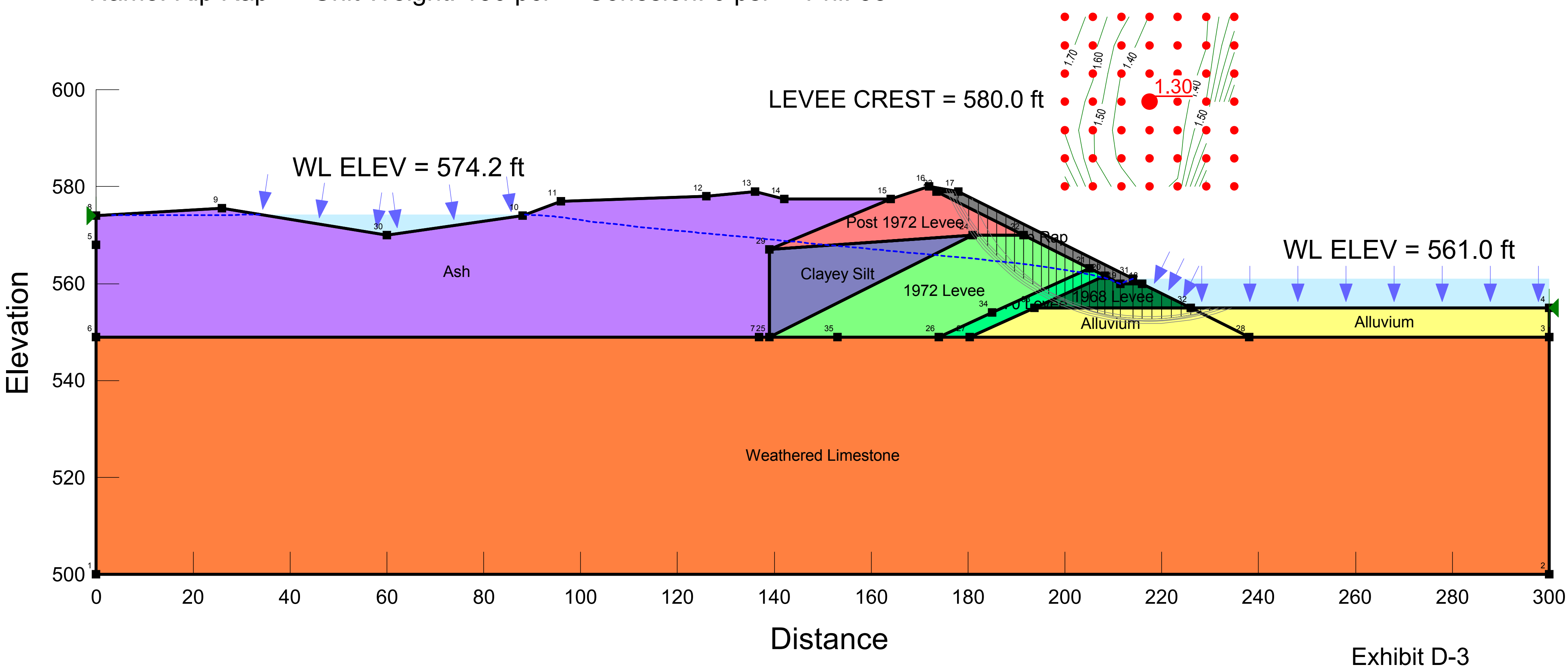


Exhibit D-3

Title: Existing Conditions - Steady State Seepage
File Name: SECT B SEEPW Existing (Steady State).gsz
Date: 11/22/2010 By: BWL

Pond Boundary Condition: H = 574.2 feet
River Boundary Condition: H = 561 feet
Pressure head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee

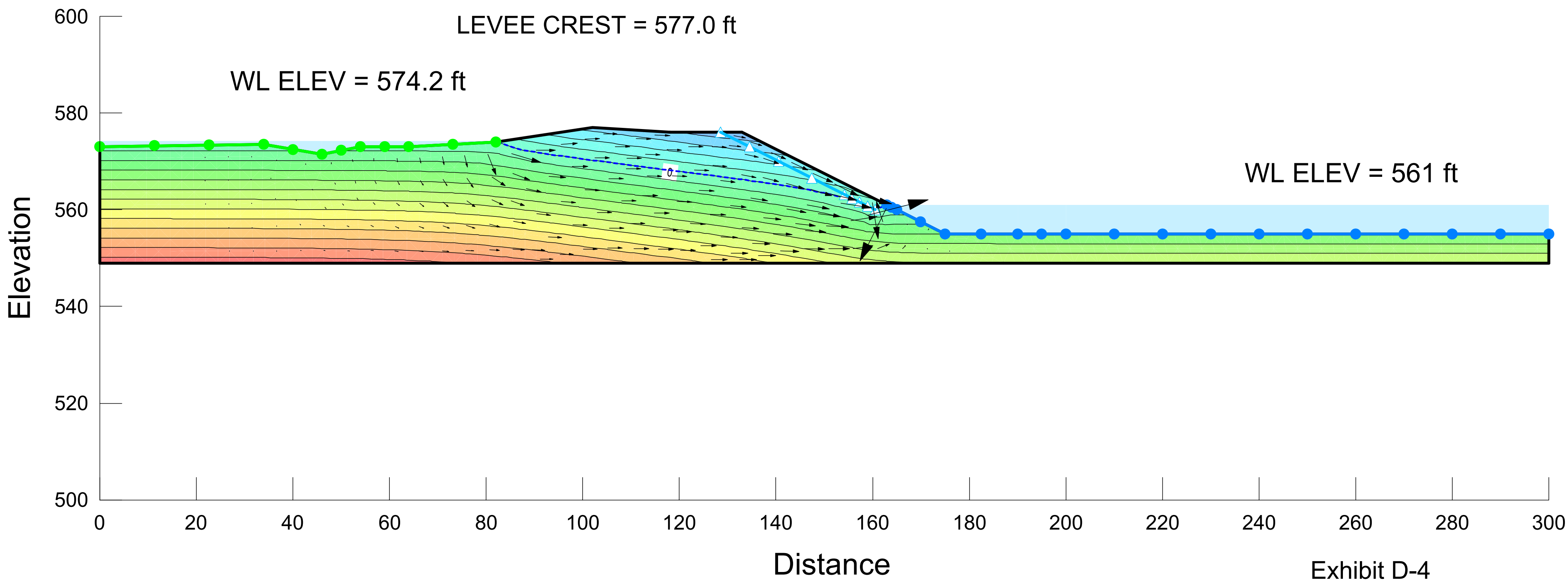


Exhibit D-4

Title: Existing Conditions - Steady State Seepage
File Name: SECT B Existing (Steady State).gsz
Date: 11/22/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Rip Rap Unit Weight: 130 pcf Cohesion: 0 psf Phi: 38 °

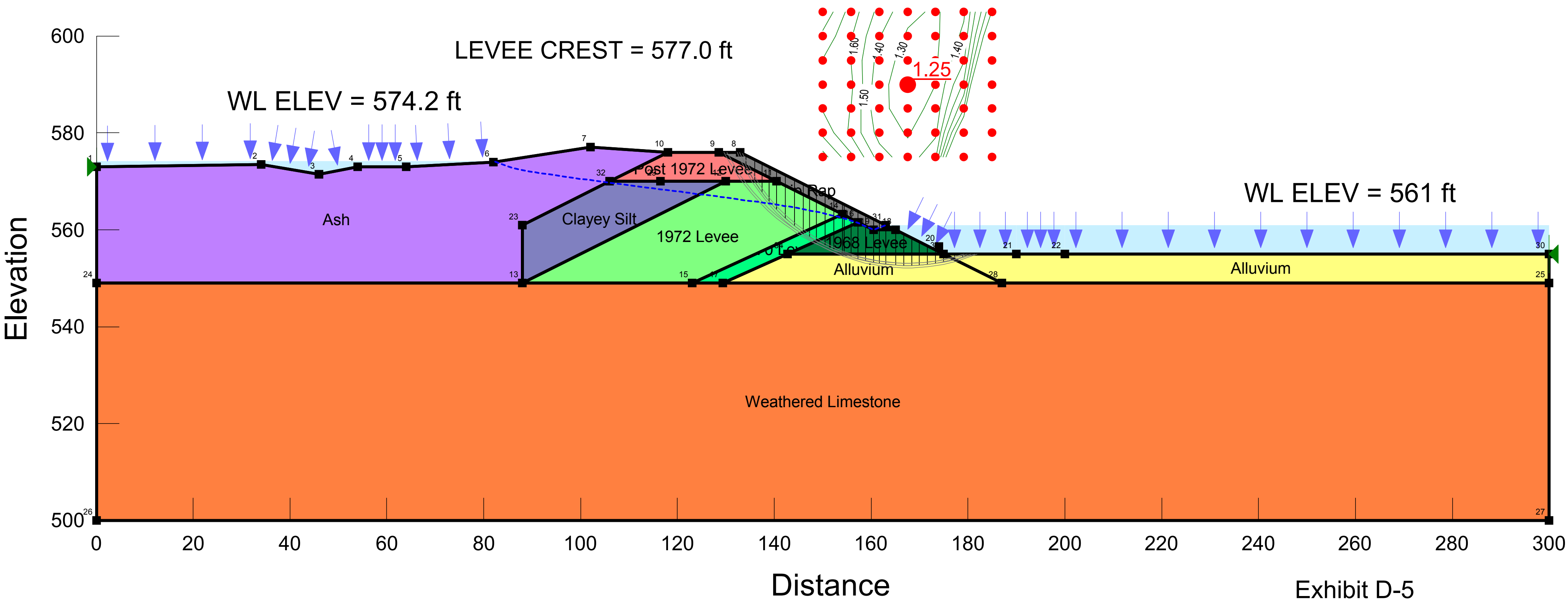


Exhibit D-5

Title: Existing Conditions - Steady State Seepage
File Name: SECT C SEEPW Existing (Steady State).gsz
Date: 11/16/2010 By: BWL

Pond Boundary Condition: H = 573.6 feet
River Boundary Condition: H = 561 feet
Pressure head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee

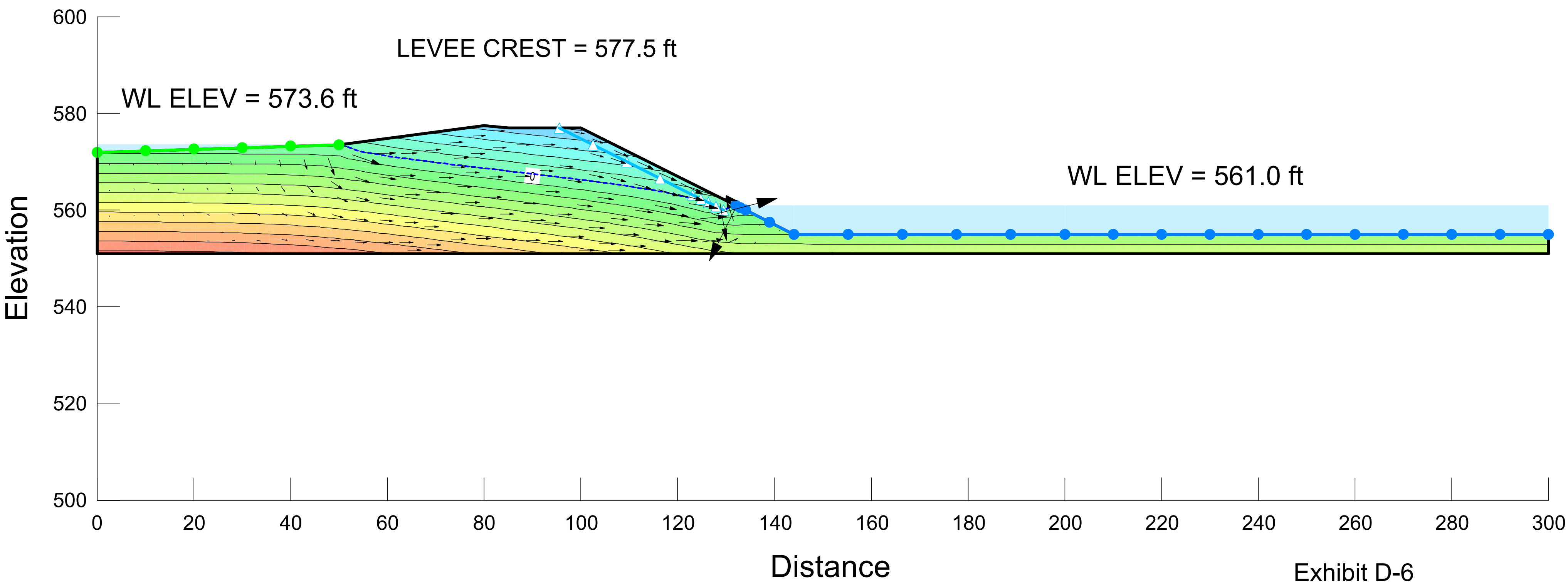


Exhibit D-6

Title: Existing Conditions - Steady State Seepage
File Name: SECT C Existing (Steady State).gsz
Date: 11/22/2010 By: BWL

Name: 1968 Levee	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 38 °
Name: 1970 Levee	Unit Weight: 100 pcf	Cohesion: 0 psf	Phi: 32 °
Name: Weathered Limestone	Unit Weight: 135 pcf	Cohesion: 0 psf	Phi: 40 °
Name: 1972 Levee	Unit Weight: 100 pcf	Cohesion: 0 psf	Phi: 35 °
Name: Post 1972 Levee	Unit Weight: 110 pcf	Cohesion: 0 psf	Phi: 35 °
Name: Clayey Silt	Unit Weight: 105 pcf	Cohesion: 0 psf	Phi: 30 °
Name: Ash	Unit Weight: 100 pcf	Cohesion: 0 psf	Phi: 32 °
Name: Alluvium	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 30 °
Name: Rip Rap	Unit Weight: 130 pcf	Cohesion: 0 psf	Phi: 38 °

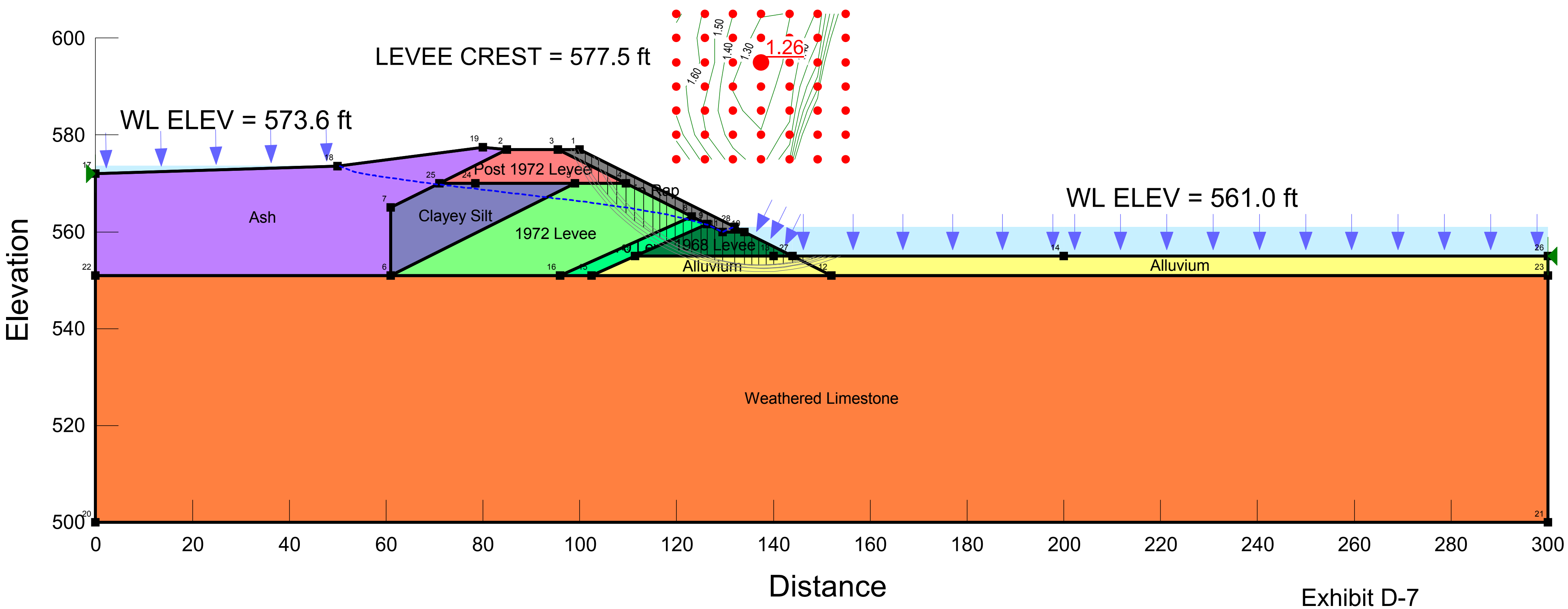


Exhibit D-7

Title: Existing Conditions - Steady State Seepage
File Name: SECT D SEEPW Existing (Steady State).gsz
Date: 11/22/2010 By: BWL

Pond Boundary Condition: H = 573.1 feet
River Boundary Condition: H = 561 feet
Pressure head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee

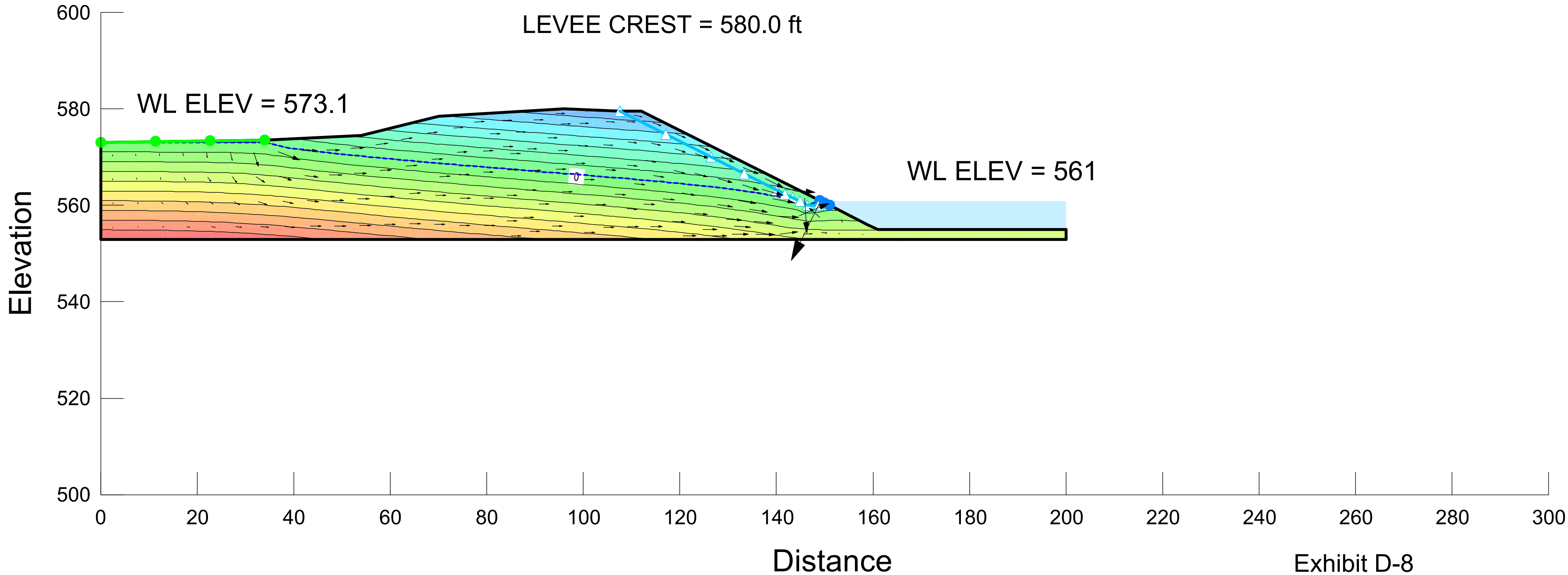


Exhibit D-8

Title: Existing Conditions - Steady State Seepage
File Name: SECT D Existing (Steady State).gsz
Date: 11/22/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Rip Rap Unit Weight: 130 pcf Cohesion: 0 psf Phi: 38 °

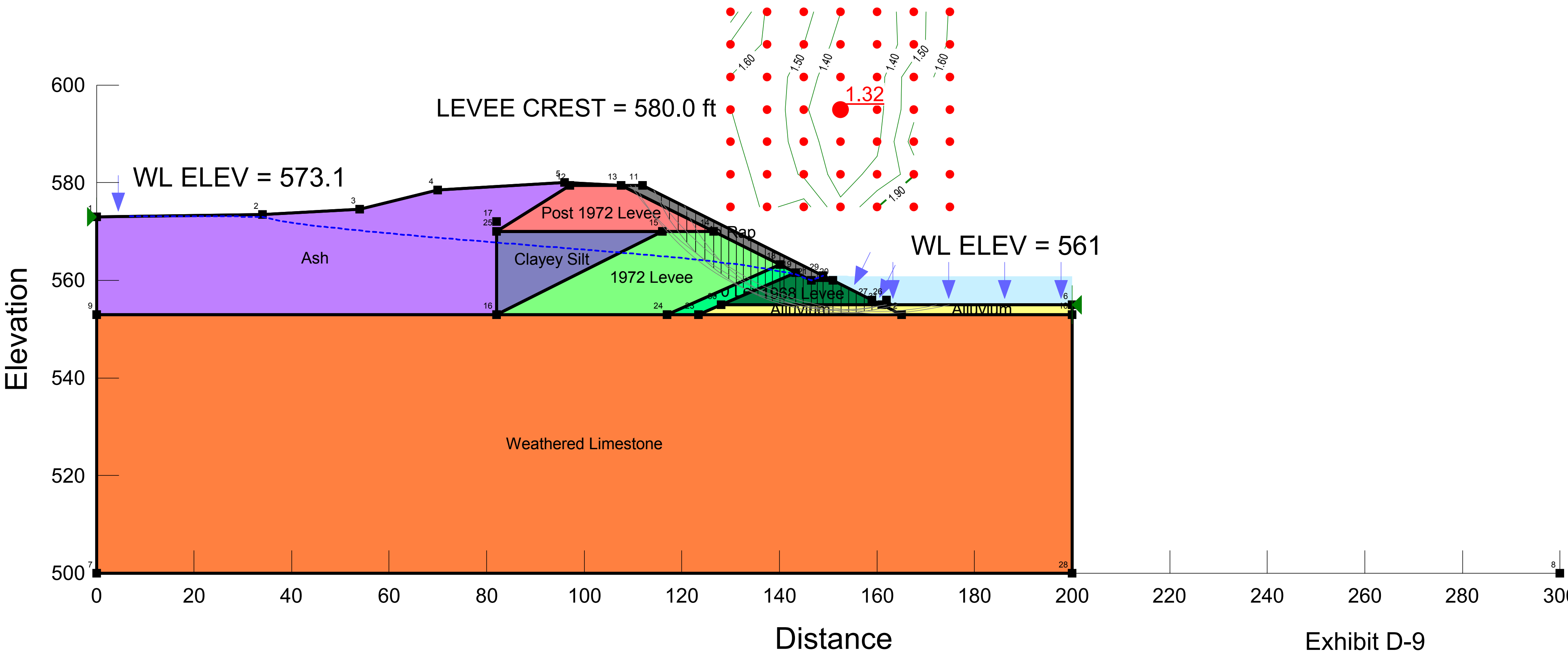


Exhibit D-9

Title: Existing Conditions - Steady State Seepage
File Name: SECT E SEEPW Existing (Steady State).gsz
Date: 11/22/2010 By: BWL

Pond Boundary Condition: H = 572.6 feet
River Boundary Condition: H = 561 feet
Pressure head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee

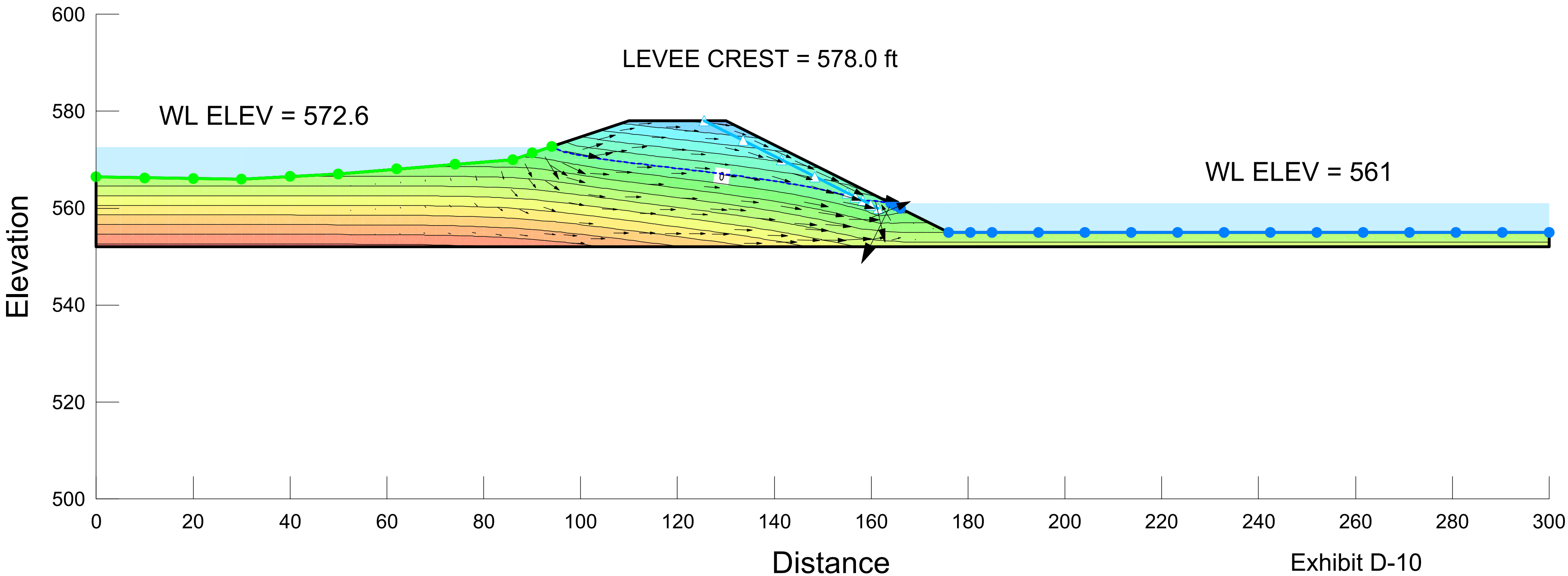


Exhibit D-10

Title: Existing Conditions - Steady State Seepage
File Name: SECT E Existing (Steady State).gsz
Date: 11/22/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Rip Rap Unit Weight: 130 pcf Cohesion: 0 psf Phi: 38 °

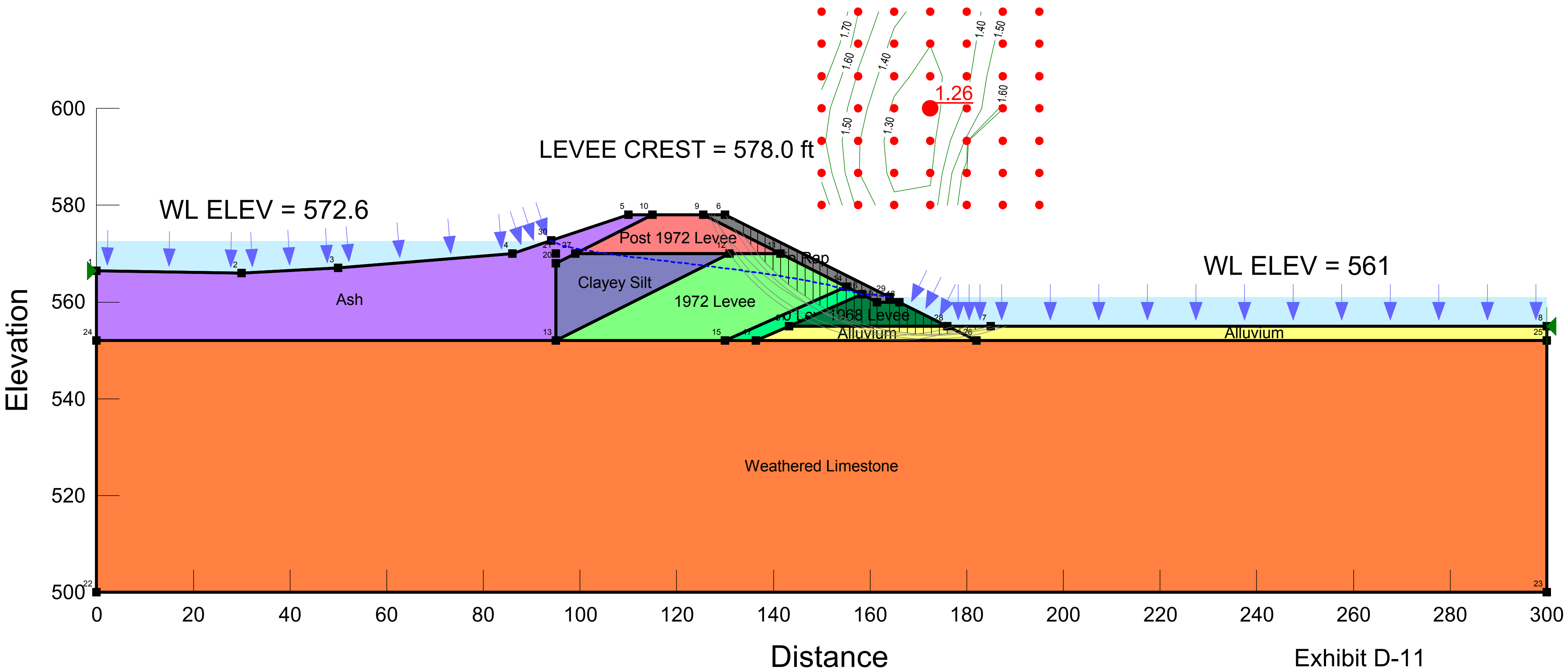


Exhibit D-11

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT A SEEPW 10ft Stabilized w 15 ft top(Steady State).gsz
Date: 11/23/2010 By: BWL

Pond Boundary Condition: H = 574.2 feet
River Boundary Condition: H = 561 feet
Pressure Head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee

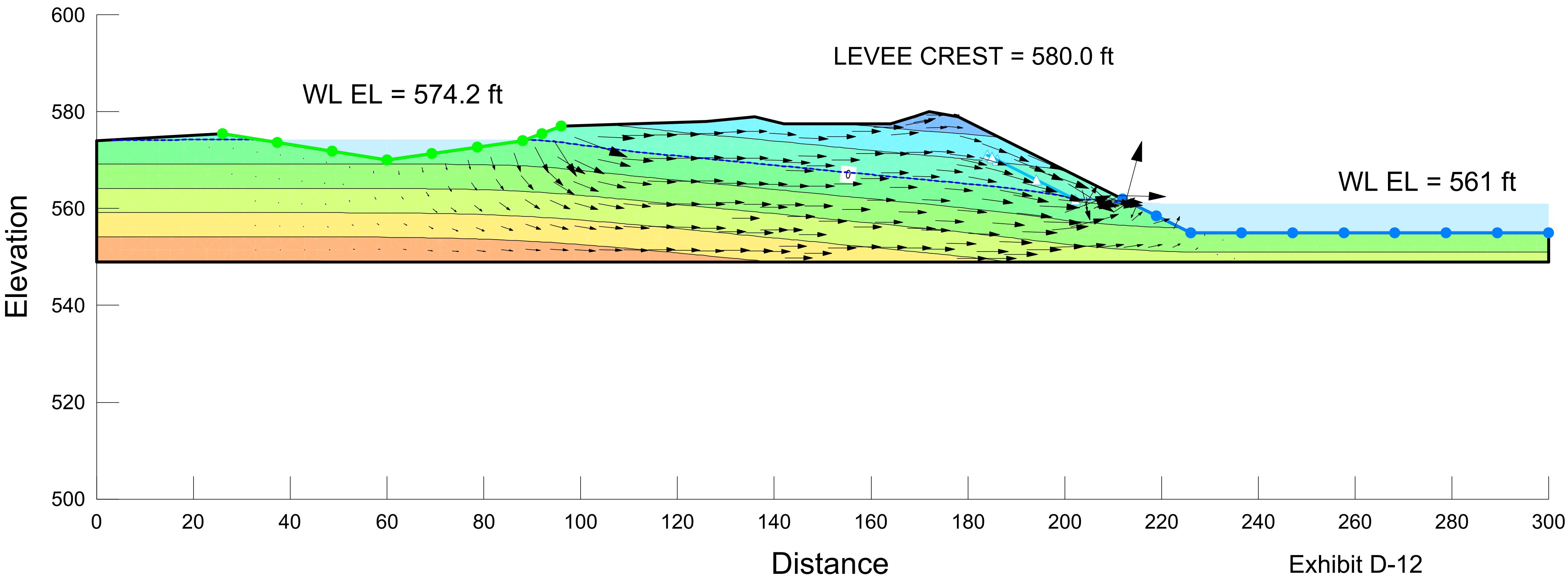


Exhibit D-12

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT A 10ft Stabilized w 15 ft top(Steady State).gsz
Date: 11/23/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Cement Stabilized Face Unit Weight: 115 pcf Cohesion: 2000 psf Phi: 0 °

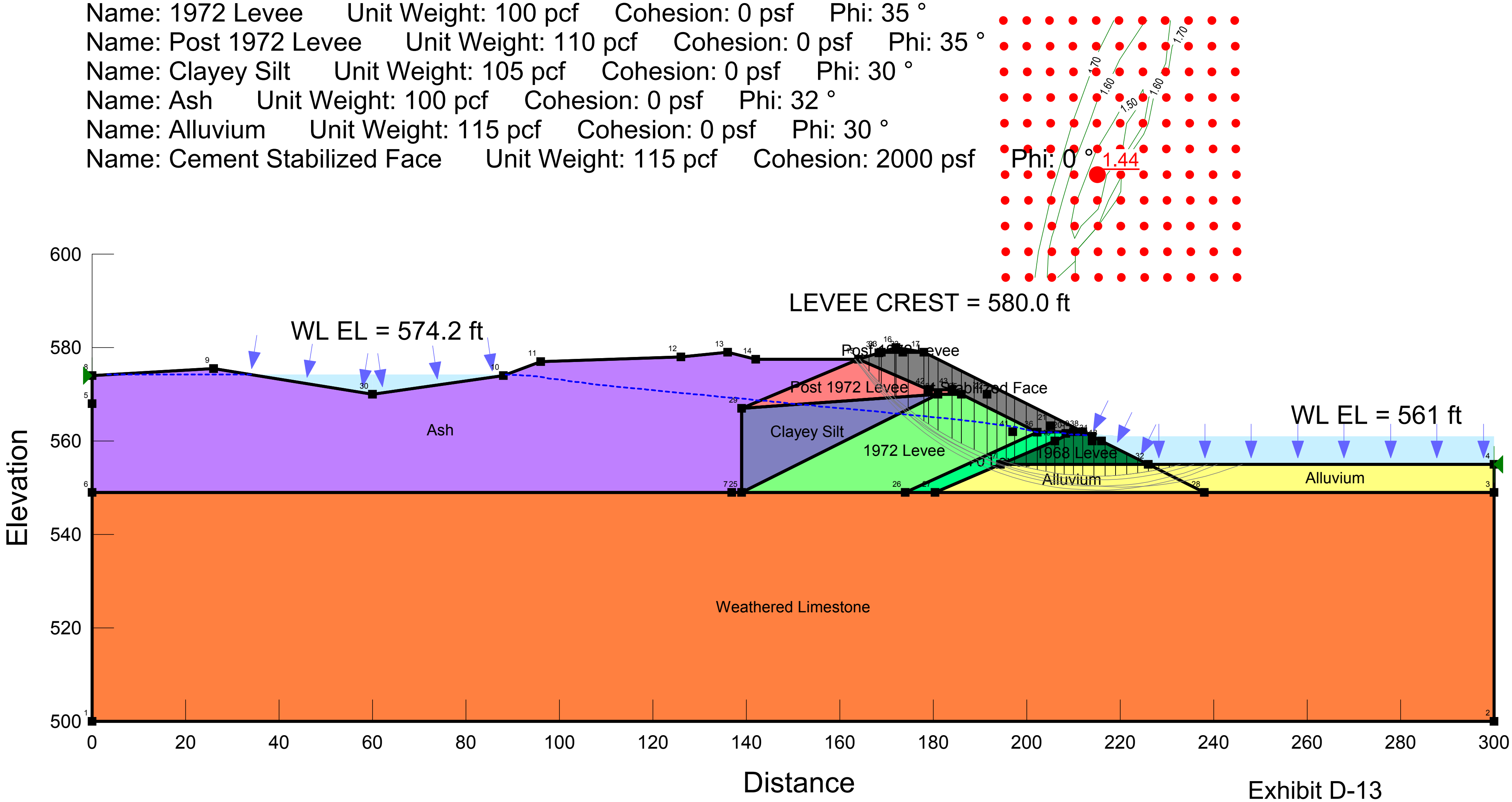


Exhibit D-13

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT B SEEPW 10-ft Stabilized w 15-ft top (Steady State).gsz
Date: 11/23/2010 By: BWL

Pond Boundary Condition: H = 574.2 feet
River Boundary Condition: H = 561 feet
Pressure Head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee

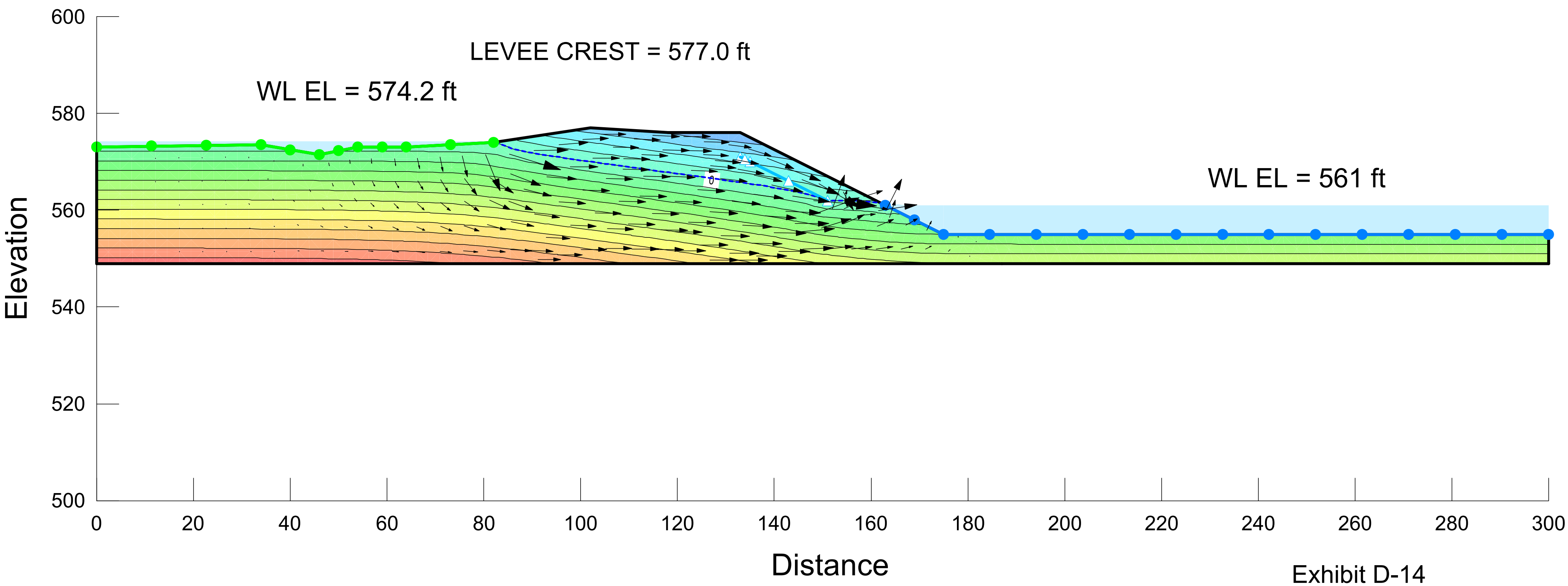


Exhibit D-14

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT B 10-ft Stabilized w 15-ft top (Steady State).gsz
Date: 11/23/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Cement Stabilized Unit Weight: 115 pcf Cohesion: 2000 psf Phi: 0 °

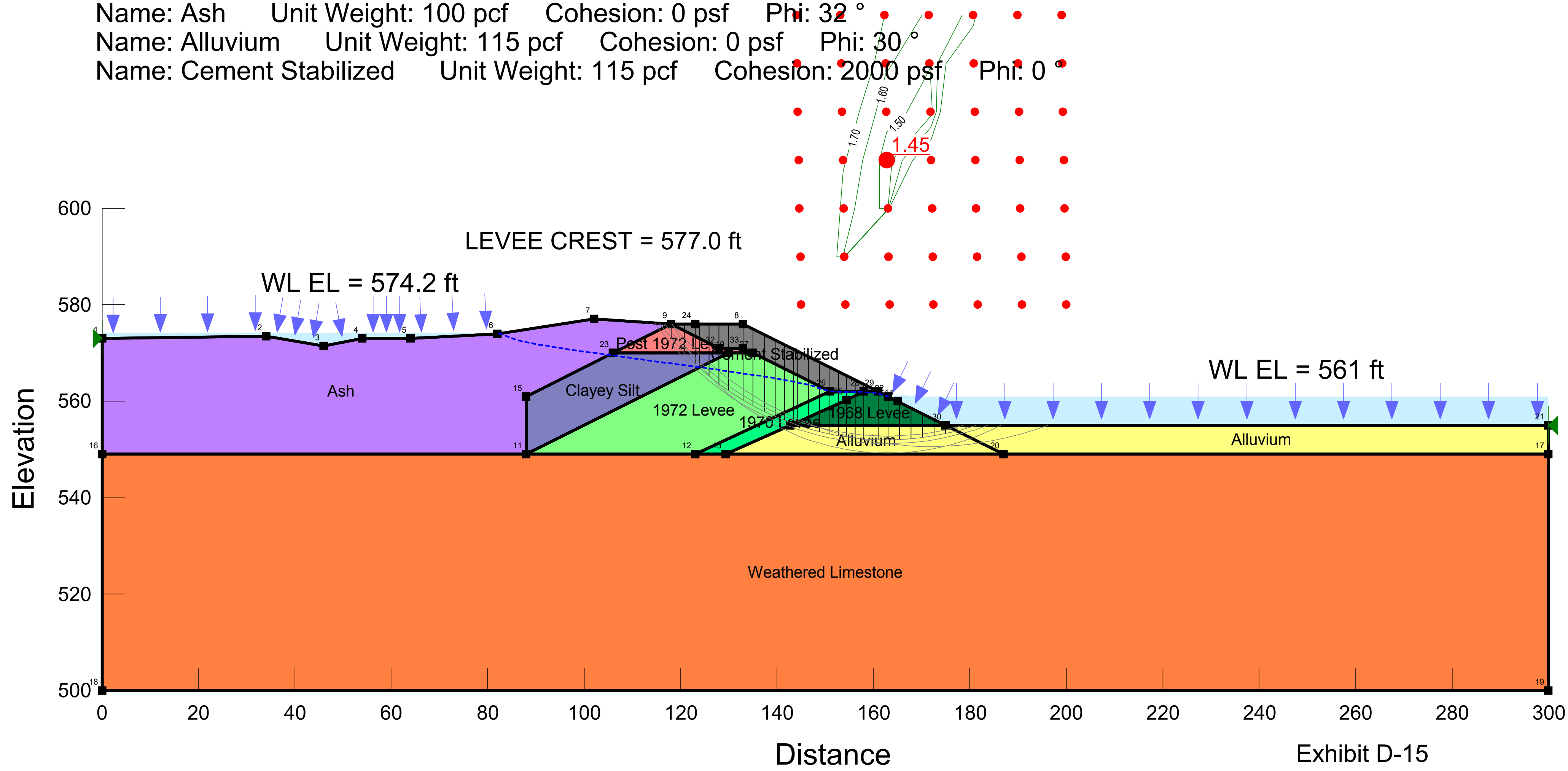


Exhibit D-15

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT C SEEPW 10-ft Stabilized w 15-ft top (Steady State).gsz
Date: 11/23/2010 By: BWL

Pond Boundary Condition: H = 573.7 feet
River Boundary Condition: H = 561 feet
Pressure Head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee

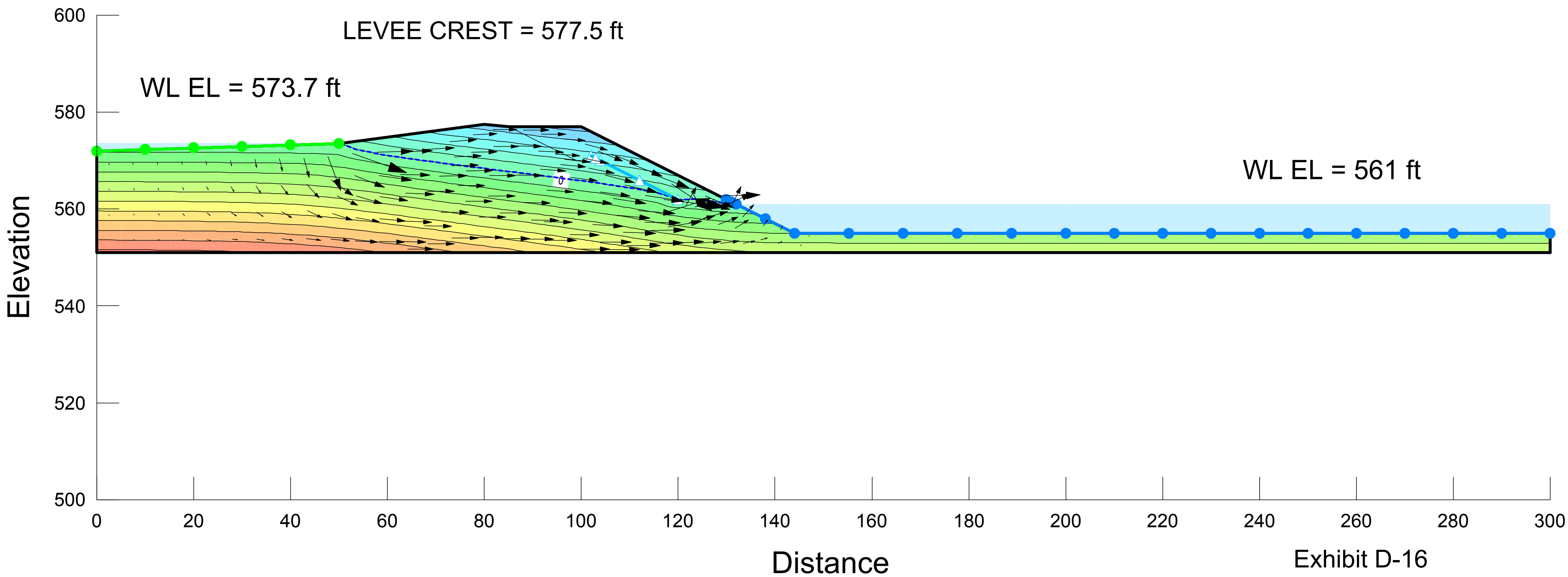


Exhibit D-16

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT C 10-ft Stabilized w 15-ft top (Steady State).gsz
Date: 11/23/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Cement Stabilized Unit Weight: 115 pcf Cohesion: 2000 psf Phi: 0 °

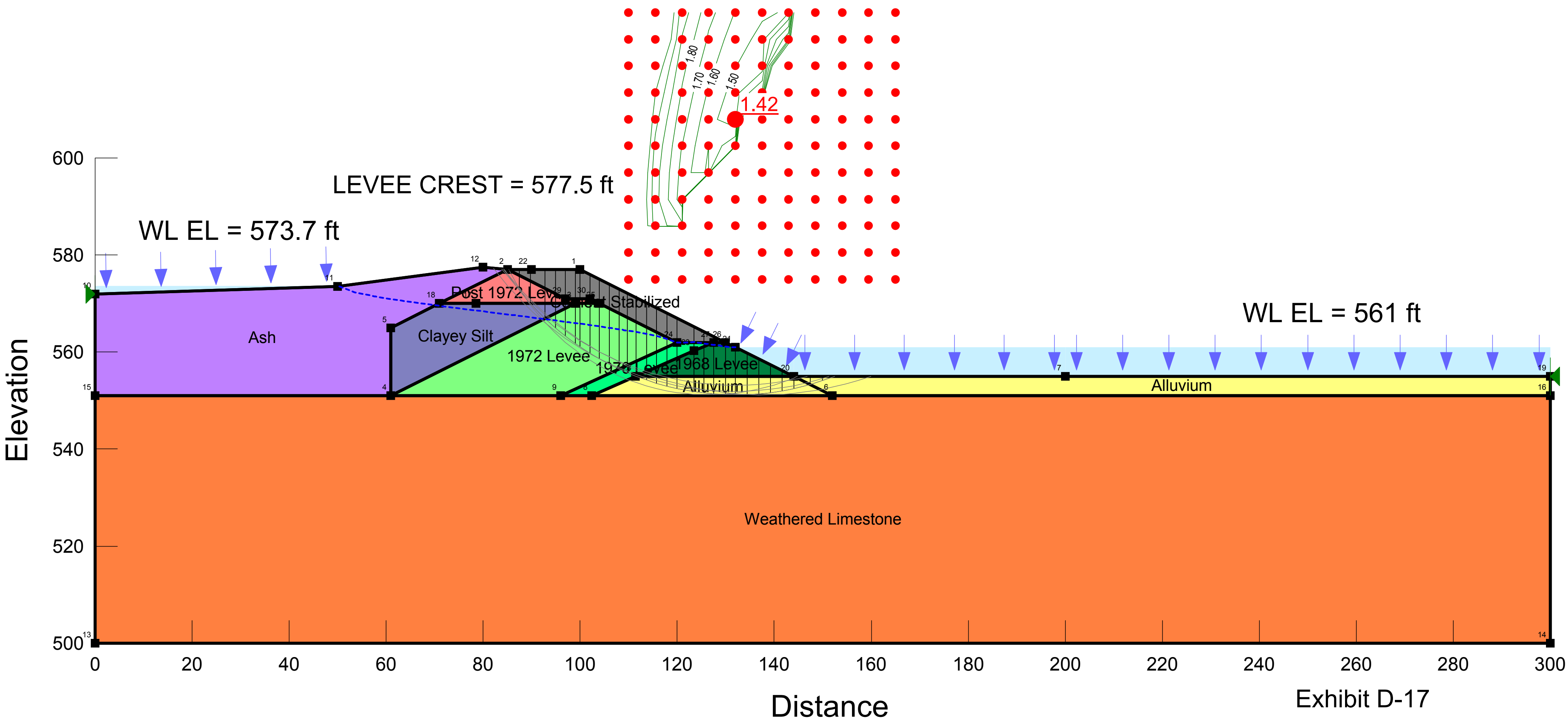
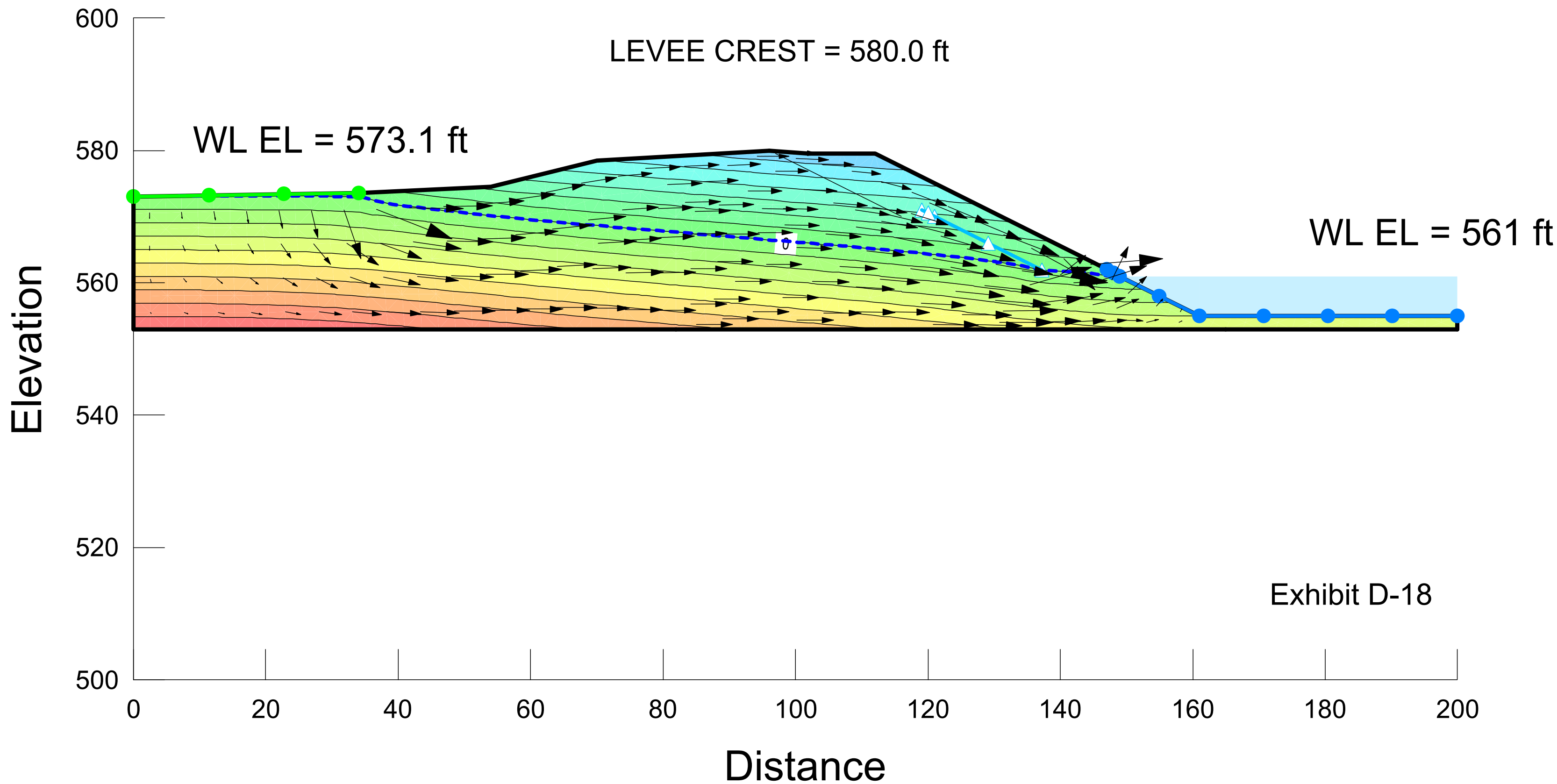


Exhibit D-17

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT D SEEP W 10-ft Stabilized w 15ft top (Steady State).gsz
Date: 11/23/2010   By: BWL

Pond Boundary Condition: H = 573.1 feet
River Boundary Condition: H = 561 feet
Pressure Head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee



Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT D 10-ft Stabilized w 15ft top (Steady State).gsz
Date: 11/23/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Cement Stabilized Unit Weight: 115 pcf Cohesion: 2000 psf Phi: 0 °

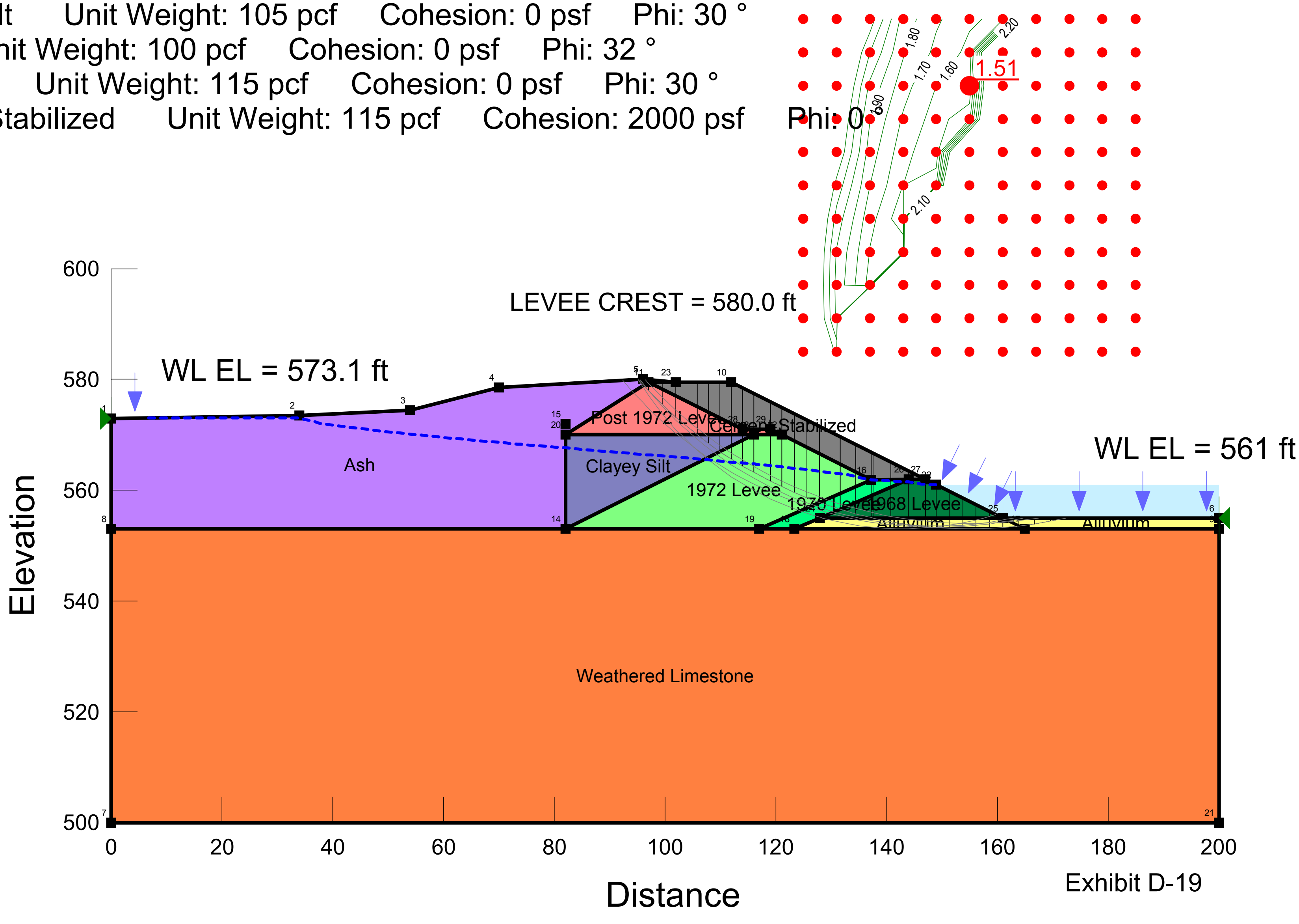


Exhibit D-19

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT E 10-ft Stabilized w top 15 ft (Steady State).gsz
Date: 11/23/2010 By: BWL

Pond Boundary Condition: H = 572.6 feet
River Boundary Condition: H = 561 feet
Pressure Head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee

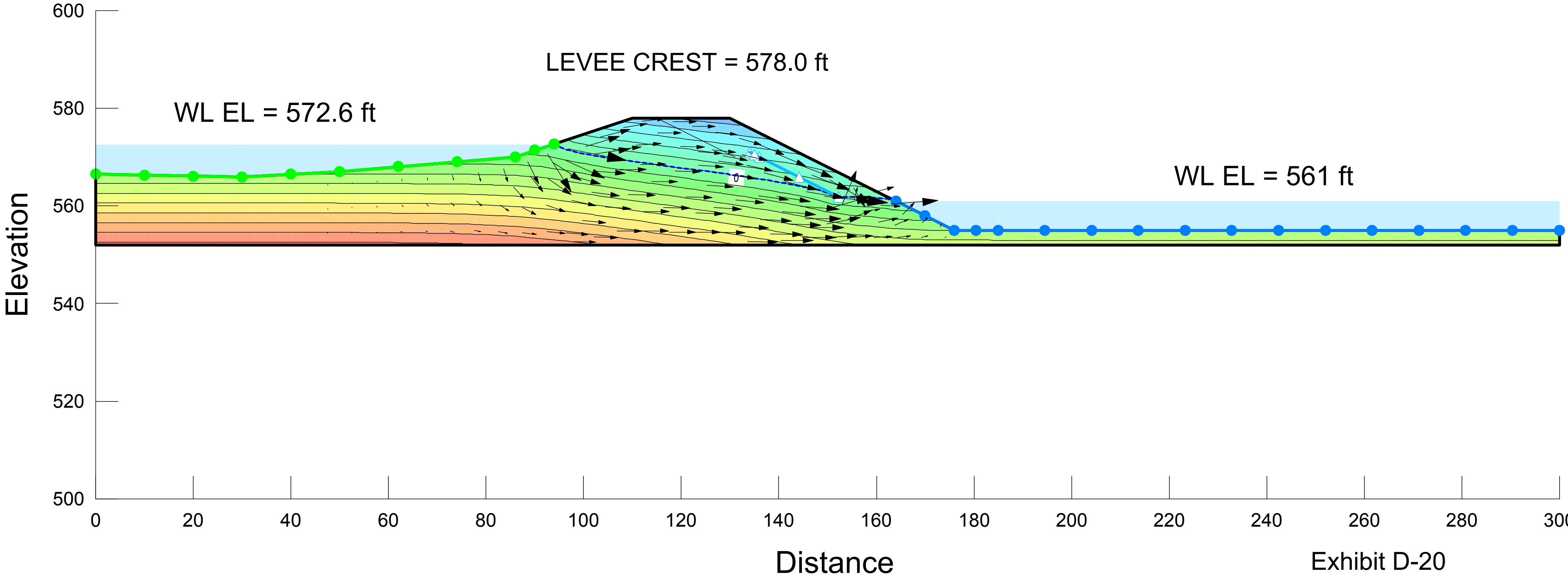


Exhibit D-20

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT E 10-ft Stabilized w top 15 ft (Steady State).gsz
Date: 11/23/2010   By: BWL

Name: 1968 Levee   Unit Weight: 120 pcf   Cohesion: 0 psf   Phi: 38 °
Name: 1970 Levee   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 32 °
Name: Weathered Limestone   Unit Weight: 135 pcf   Cohesion: 0 psf   Phi: 40 °
Name: 1972 Levee   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 35 °
Name: Post 1972 Levee   Unit Weight: 110 pcf   Cohesion: 0 psf   Phi: 35 °
Name: Clayey Silt   Unit Weight: 105 pcf   Cohesion: 0 psf   Phi: 30 °
Name: Ash   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 32 °
Name: Alluvium   Unit Weight: 115 pcf   Cohesion: 0 psf   Phi: 30 °
Name: Cement Stabilized   Unit Weight: 115 pcf   Cohesion: 2000 psf   Phi: 0 °

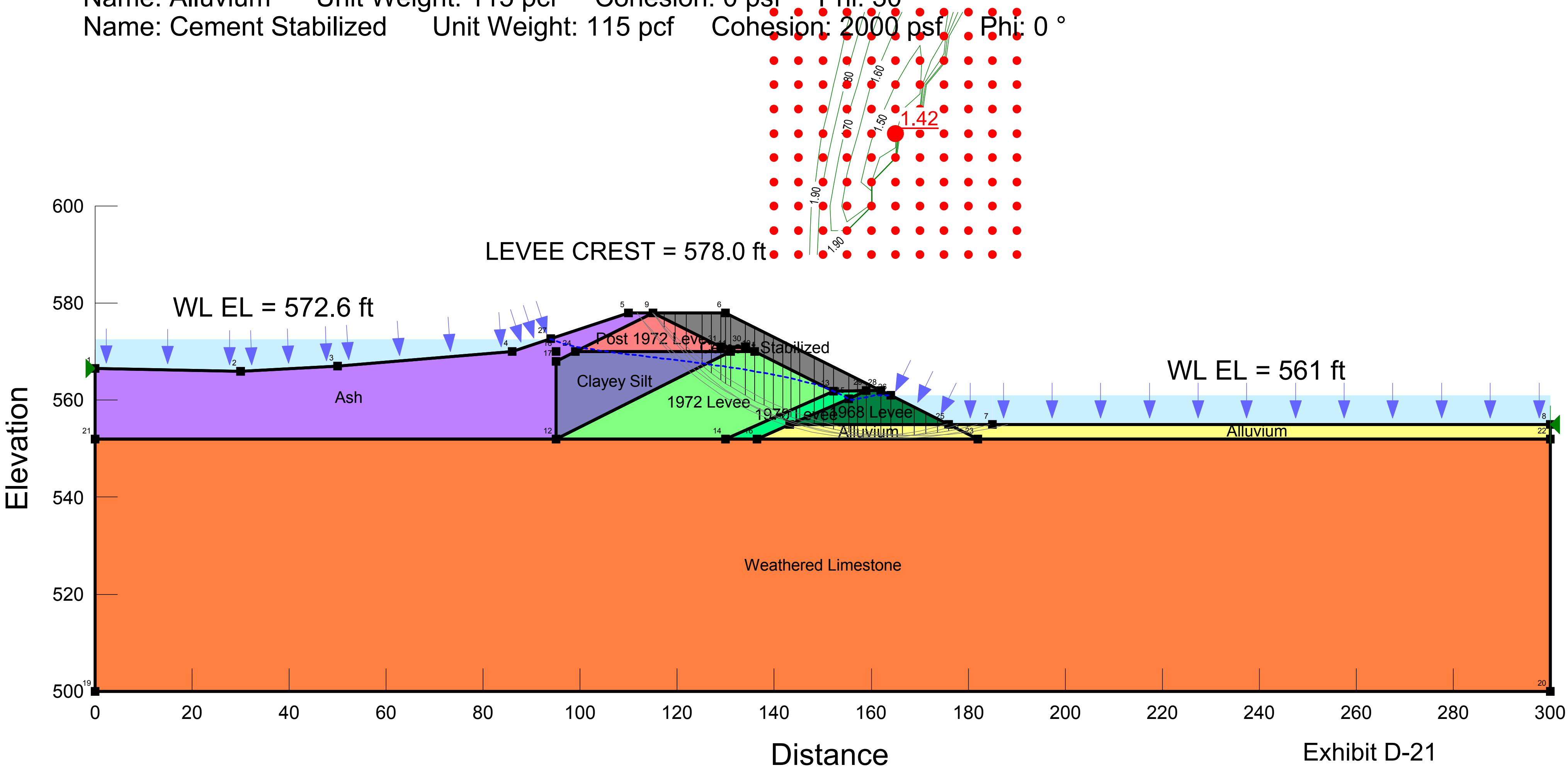


Exhibit D-21

Title: 10-ft Stabilized Face - Drawdown
File Name: SECT A 10ft Stabilized w 15 ft top(Drawdown).gsz
Date: 11/23/2010   By: BWL

Name: 1968 Levee   Unit Weight: 120 pcf   Cohesion: 0 psf   Phi: 38 °
Name: 1970 Levee   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 32 °
Name: Weathered Limestone   Unit Weight: 135 pcf   Cohesion: 0 psf   Phi: 40 °
Name: 1972 Levee   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 35 °
Name: Post 1972 Levee   Unit Weight: 110 pcf   Cohesion: 0 psf   Phi: 35 °
Name: Clayey Silt   Unit Weight: 105 pcf   Cohesion: 0 psf   Phi: 30 °
Name: Ash   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 32 °
Name: Alluvium   Unit Weight: 115 pcf   Cohesion: 0 psf   Phi: 30 °
Name: Cement Stabilized Face   Unit Weight: 115 pcf   Cohesion: 2000 psf   Phi: 0 °

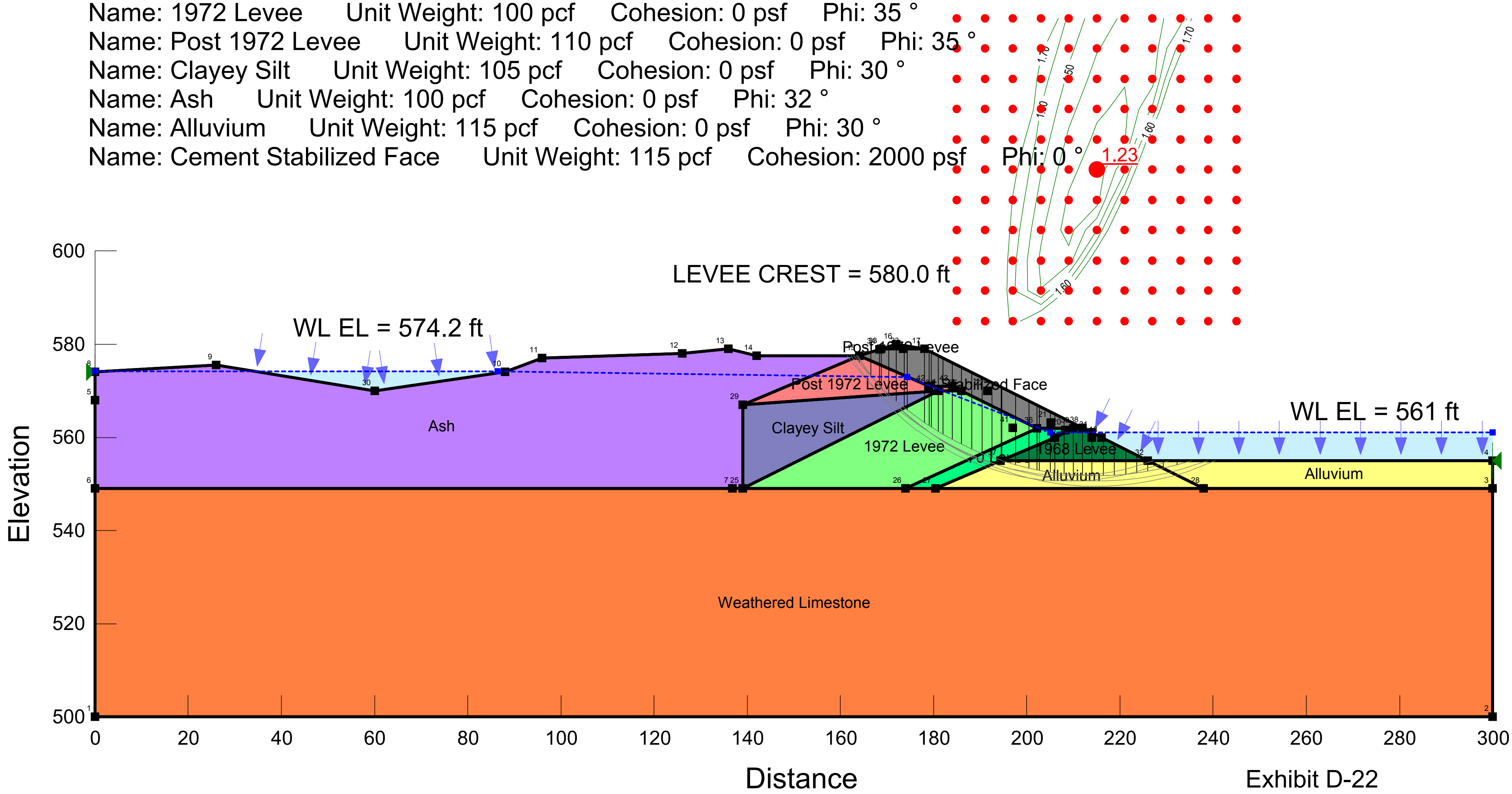


Exhibit D-22

Title: 10-ft Stabilized Face - Drawdown
File Name: SECT B 10-ft Stabilized w 15-ft top (Drawdown).gsz
Date: 11/23/2010   By: BWL

Name: 1968 Levee   Unit Weight: 120 pcf   Cohesion: 0 psf   Phi: 38 °
Name: 1970 Levee   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 32 °
Name: Weathered Limestone   Unit Weight: 135 pcf   Cohesion: 0 psf   Phi: 40 °
Name: 1972 Levee   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 35 °
Name: Post 1972 Levee   Unit Weight: 110 pcf   Cohesion: 0 psf   Phi: 35 °
Name: Clayey Silt   Unit Weight: 105 pcf   Cohesion: 0 psf   Phi: 30 °
Name: Ash   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 32 °
Name: Alluvium   Unit Weight: 115 pcf   Cohesion: 0 psf   Phi: 30 °
Name: Cement Stabilized   Unit Weight: 115 pcf   Cohesion: 2000 psf   Phi: 0 °

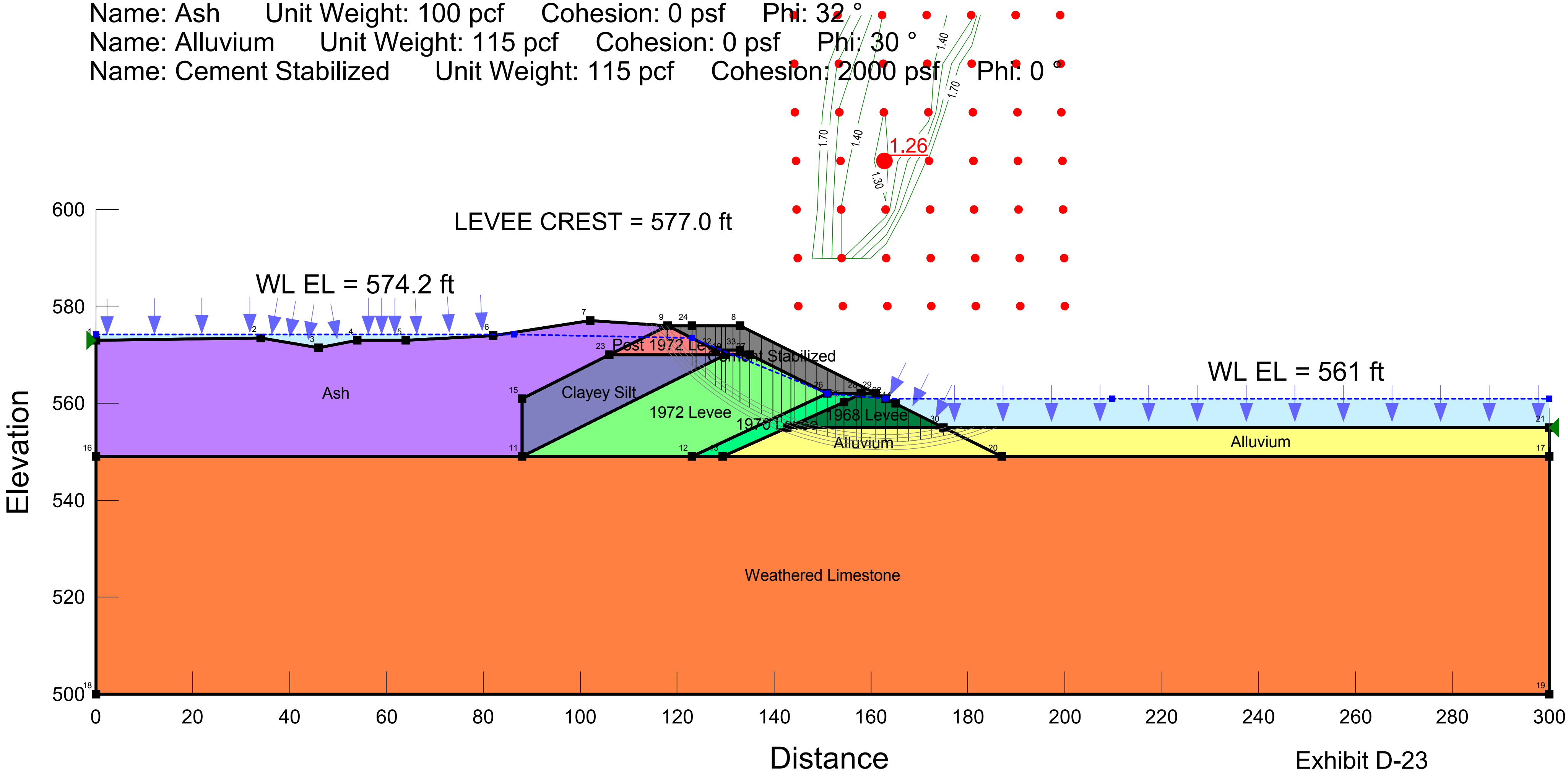


Exhibit D-23

Title: 10-ft Stabilized Face - Drawdown
File Name: SECT C 10-ft Stabilized w 15-ft top (Drawdown).gsz
Date: 11/23/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Cement Stabilized Unit Weight: 115 pcf Cohesion: 2000 psf Phi: 0 °

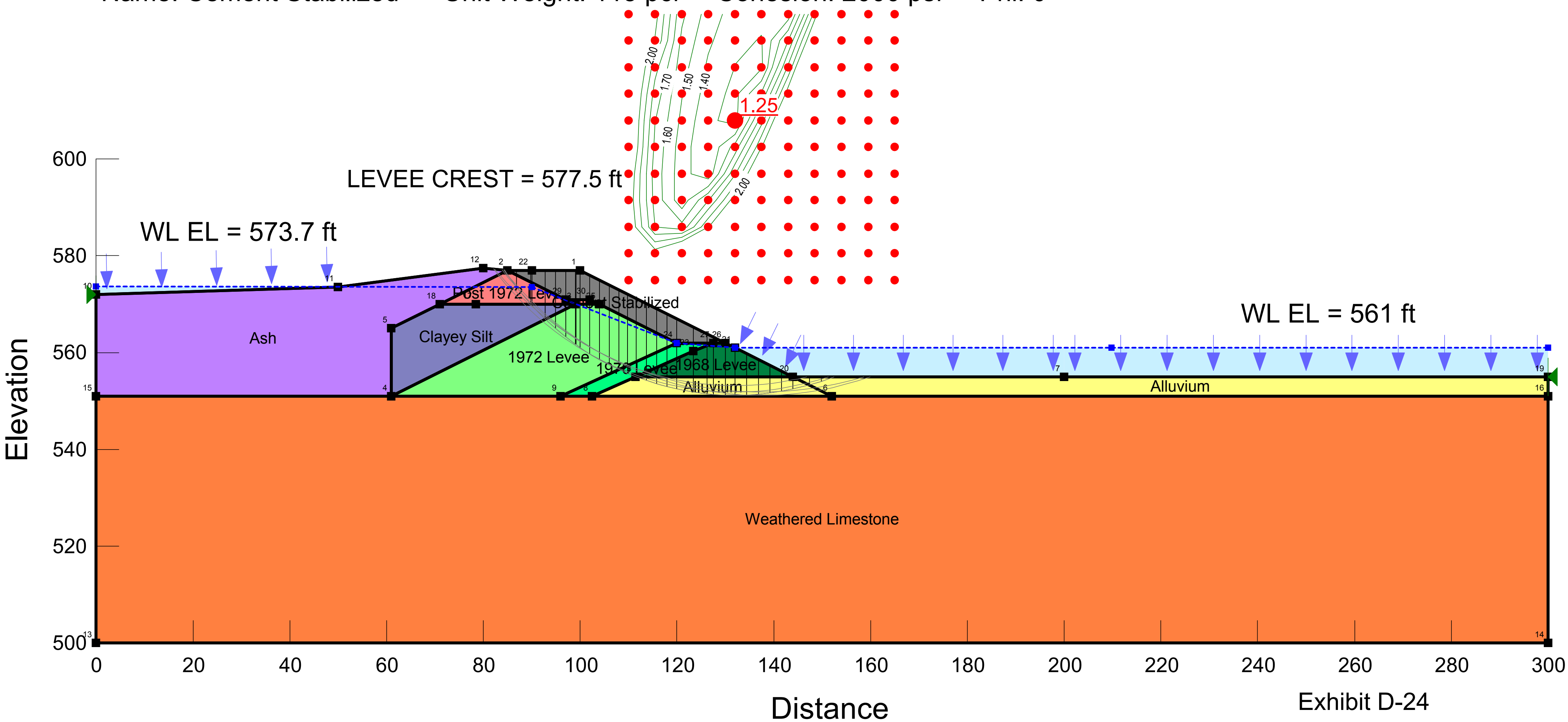


Exhibit D-24

Title: 10-ft Stabilized Face - Drawdown
File Name: SECT D 10-ft Stabilized w 15ft top (Drawdown).gsz
Date: 11/23/2010   By: BWL

Name: 1968 Levee   Unit Weight: 120 pcf   Cohesion: 0 psf   Phi: 38 °
Name: 1970 Levee   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 32 °
Name: Weathered Limestone   Unit Weight: 135 pcf   Cohesion: 0 psf   Phi: 40 °
Name: 1972 Levee   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 35 °
Name: Post 1972 Levee   Unit Weight: 110 pcf   Cohesion: 0 psf   Phi: 35 °
Name: Clayey Silt   Unit Weight: 105 pcf   Cohesion: 0 psf   Phi: 30 °
Name: Ash   Unit Weight: 100 pcf   Cohesion: 0 psf   Phi: 32 °
Name: Alluvium   Unit Weight: 115 pcf   Cohesion: 0 psf   Phi: 30 °
Name: Cement Stabilized   Unit Weight: 115 pcf   Cohesion: 2000 psf   Phi: 0 °

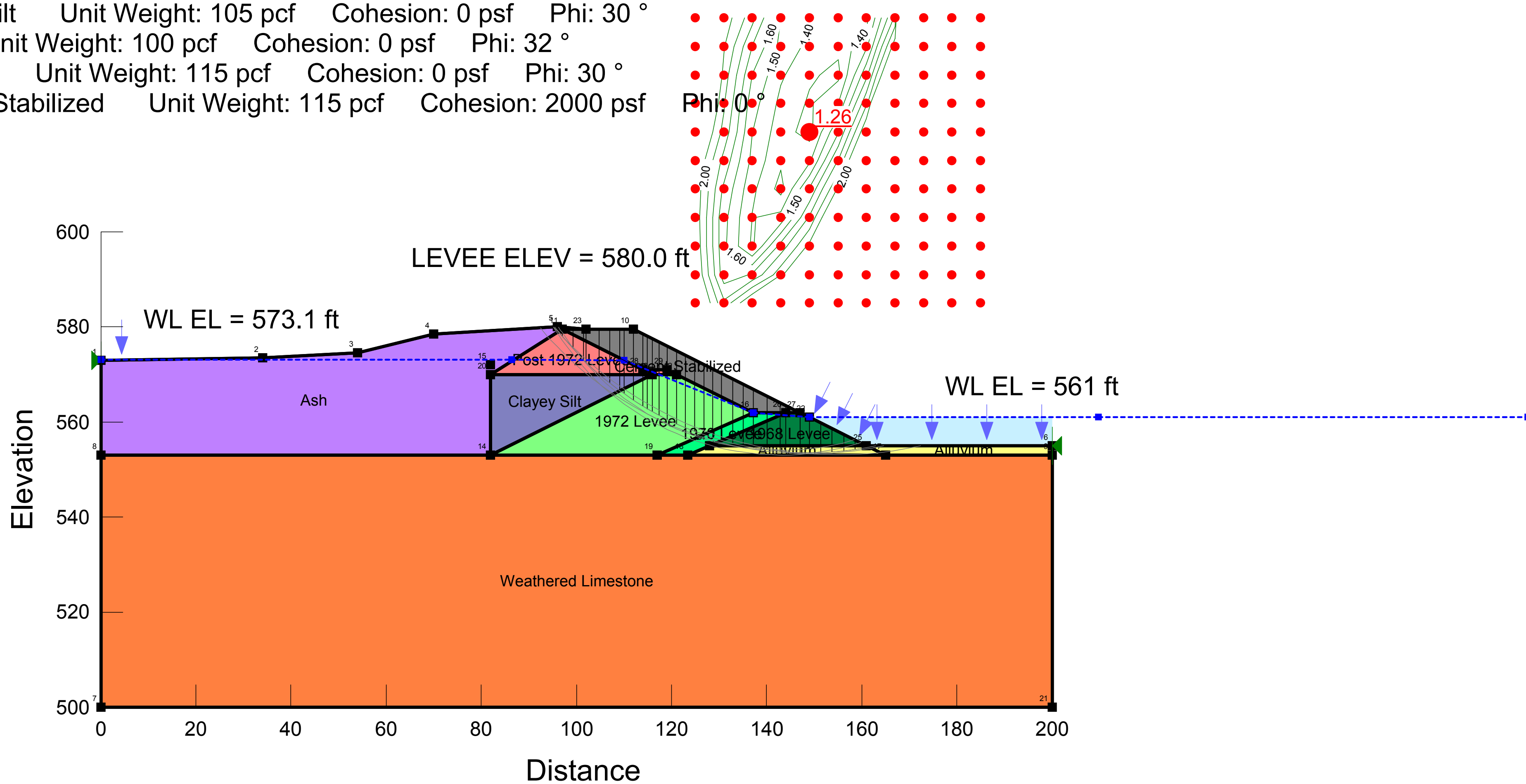


Exhibit D-25

Title: 10-ft Stabilized Face - Drawdown
File Name: SECT E 10-ft Stabilized w top 15 ft (Drawdown).gsz
Date: 11/23/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Cement Stabilized Unit Weight: 115 pcf Cohesion: 2000 psf Phi: 0 °

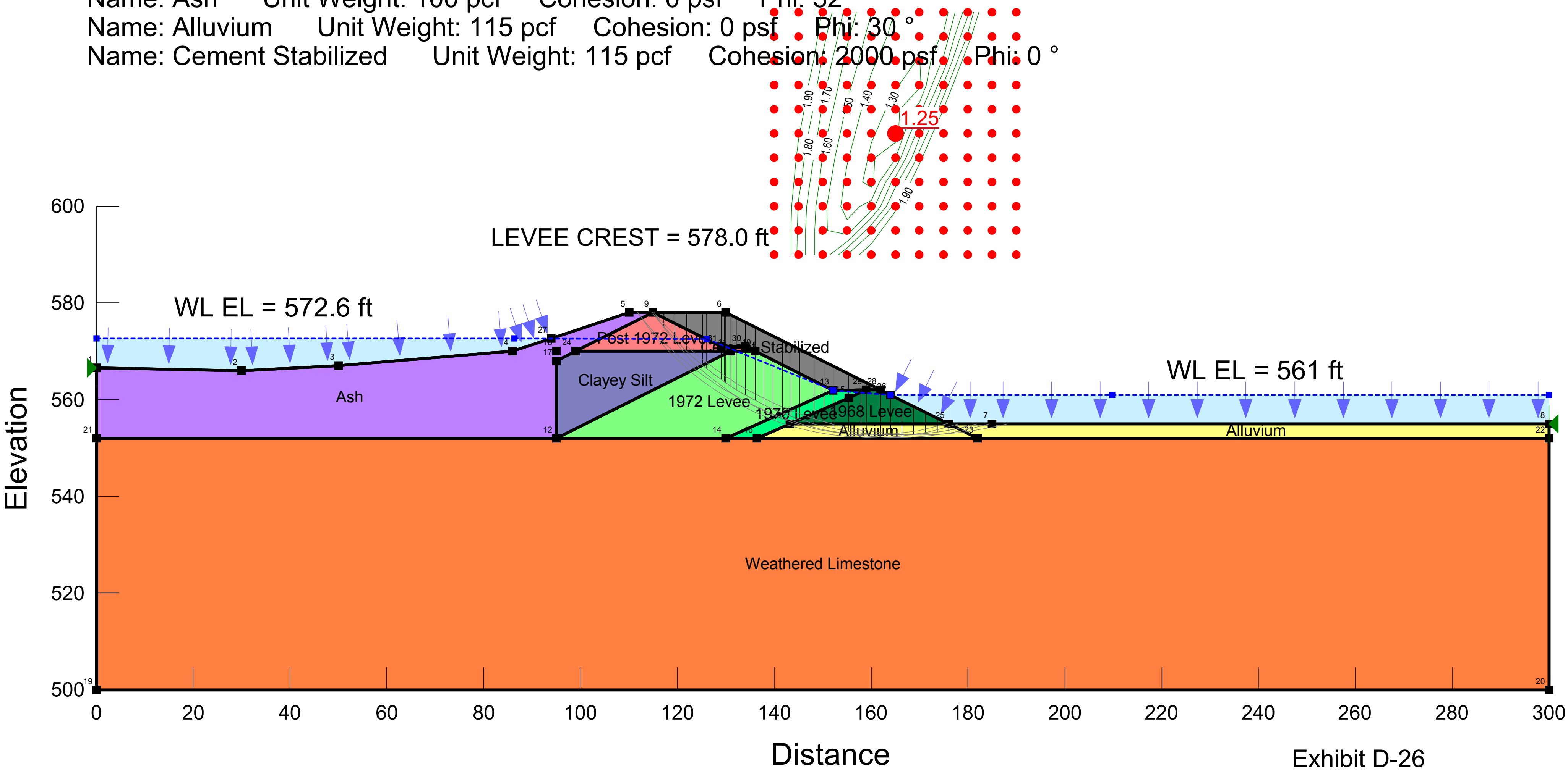


Exhibit D-26

Title: Temporary Excavation - Steady State Seepage
File Name: SECT C SEEPW 10-ft Stabilized w 15-ft top (Temp Exc).gsz
Date: 11/23/2010 By: BWL

Pond Boundary Condition: H = 573.7 ft
River Boundary Condition: H = 561 ft
Pressure Head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee
Name: Null

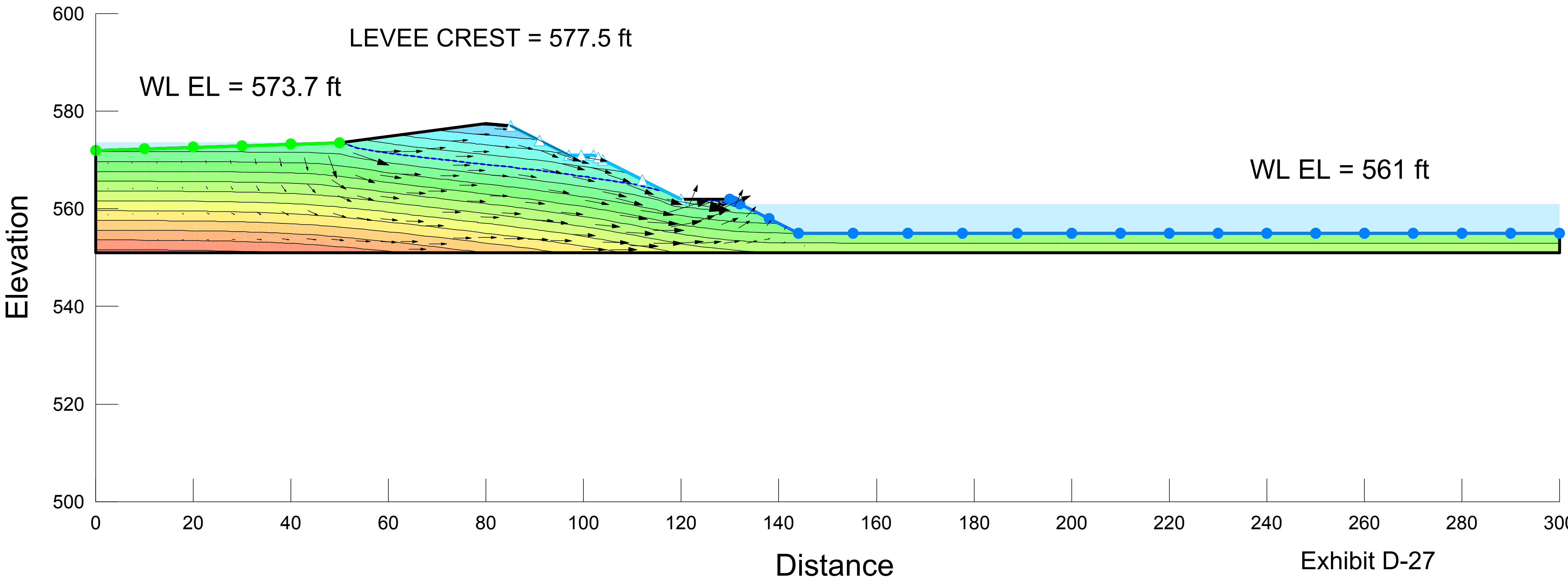


Exhibit D-27

Title: Temporary Excavation - Steady State Seepage
File Name: SECT C 10-ft Stabilized w 15-ft top (Temp Exc).gsz
Date: 11/23/2010 By: BWL

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Null

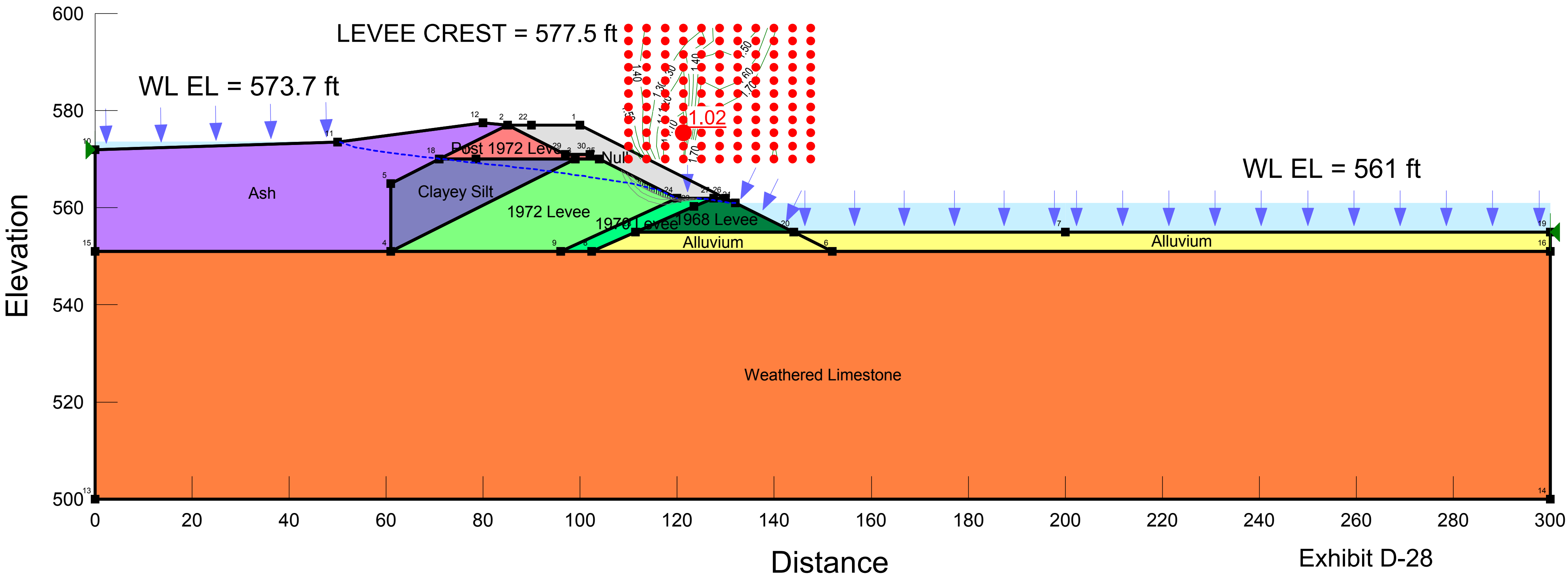


Exhibit D-28

Title: Temporary Excavation - Well Drawdown
File Name: SECT C SEEPW 10-ft Stabilized w 15-ft top (Temp Exc-Well Drawdown).gsz
Date: 11/23/2010 By: BWL

Pond Boundary Condition: H = 573.7 feet
River Boundary Condition: H = 561 feet
Well Line Boundary Conditions: H = 565 feet
Pressure Head contours
Phreatic Surface = P = 0
Ksat_x = 3.3e-6 ft/sec (isotropic, steady state)

Name: 1968 Levee
Name: Null

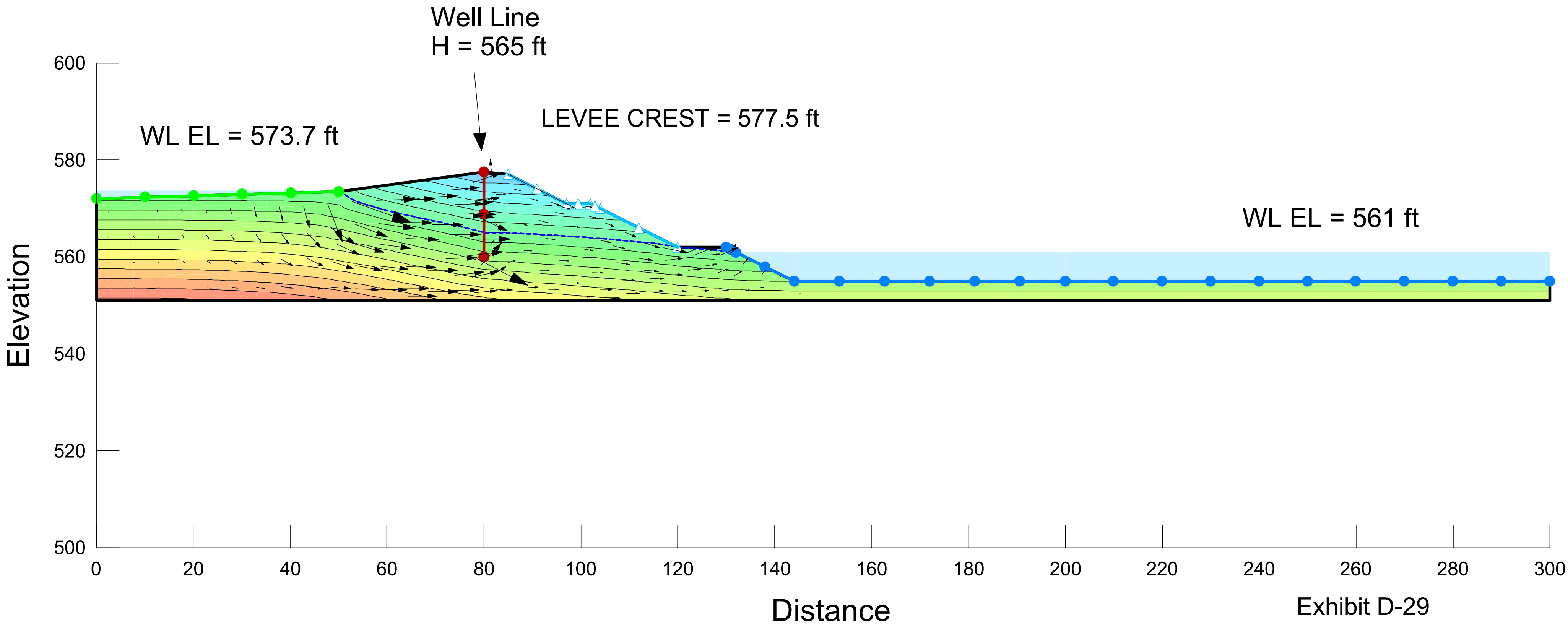


Exhibit D-29

Title: Temporary Excavation - Well Drawdown
File Name: SECT C 10-ft Stabilized w 15-ft top (Temp Exc-Well Drawdown).gsz
Date: 11/23/2010 By: BWL

Name	Unit Weight	Cohesion	Phi
Name: 1968 Levee	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 38 °
Name: 1970 Levee	Unit Weight: 100 pcf	Cohesion: 0 psf	Phi: 32 °
Name: Weathered Limestone	Unit Weight: 135 pcf	Cohesion: 0 psf	Phi: 40 °
Name: 1972 Levee	Unit Weight: 100 pcf	Cohesion: 0 psf	Phi: 35 °
Name: Post 1972 Levee	Unit Weight: 110 pcf	Cohesion: 0 psf	Phi: 35 °
Name: Clayey Silt	Unit Weight: 105 pcf	Cohesion: 0 psf	Phi: 30 °
Name: Ash	Unit Weight: 100 pcf	Cohesion: 0 psf	Phi: 32 °
Name: Alluvium	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 30 °
Name: Null			

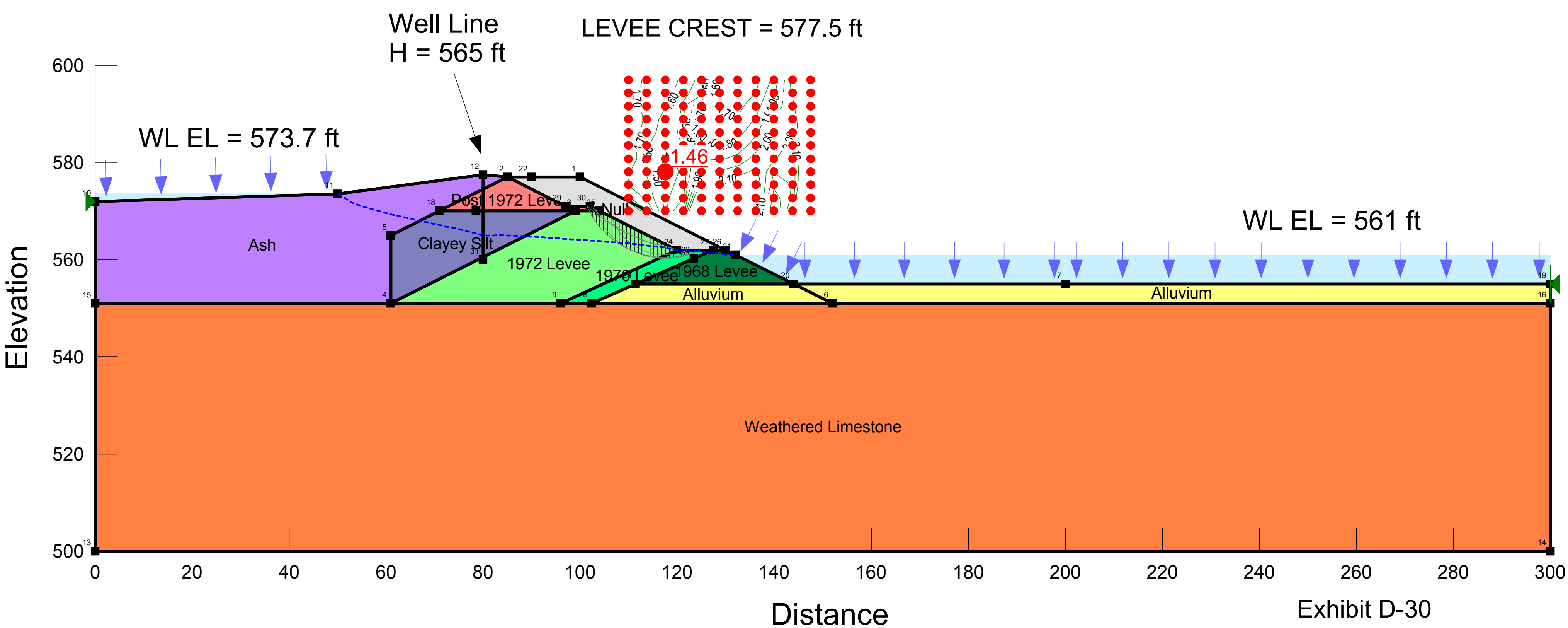


Exhibit D-30

Dodson, Kevin D

From:	Schultzen, Jeffrey
Sent:	Monday, February 28, 2011 1:57 PM
To:	Dodson, Kevin D
Cc:	Nelson, Sam L
Subject:	FW: Port Neal pdf's
Attachments:	HWS Proposal for MidAmerican Ash Pond Rehabilitation Design.pdf

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From: Sweeney, Shad C
Sent: Friday, February 11, 2011 2:23 PM
To: Schultzen, Jeffrey
Cc: Nelson, Sam L; Keegel, DeWayne L
Subject: FW: Port Neal pdf's

Jeff,

HWS' response to our question regarding the maximum operating level for 3B South Pond is below as well as an explanation as to why this information was not included in the Geotechnical Report.

Thanks,

Shad

From: Doland, Frank [mailto:FDoland@benesch.com]
Sent: Friday, February 11, 2011 2:19 PM
To: Sweeney, Shad C
Subject: FW: Port Neal pdf's

Shad: Please read the summary from our Geotechs below. After you have time to review please let us know if you'd like anything developed farther.

Thanks!

From: Desh, Brandon
Sent: Friday, February 11, 2011 10:52 AM
To: Doland, Frank
Cc: Proskovec, Gary
Subject: RE: Port Neal pdf's

Frank,

Analyses were completed and the calculated maximum pool elevation for Unit 3B-South was determined to be 1079.5 feet with the known floor elevation from the survey completed in 2009 and this was discussed with Mid American Energy (Shad and DeWayne) via telephone conversation in December 2009.

My recollection is there were potential changes MAE was considering to some of the items to be addressed in the addendum geotechnical report and the design plans to improve operations in the units (i.e. culvert locations between units, modifications to unit floor in 3B-South, etc.).

The contract documents I have in our file show these services were being provided under a PO 167231 (HWS proposal dated 8-7-09 for Geotechnical, Survey, and Design Services is attached), but the project was put on hold, therefore completion of an addendum geotechnical report was put on hold as well.

Did your group complete remediation design plans and specifications for MAE that were included in this proposal before the project was put on hold, as I don't have copies of any plans or specs in my working file?

The last thing I recall on the project was that you and Gary had put together another proposal for MAE for additional design services, but don't know what came to be of that?

Moving ahead, once we know what type of documentation MAE would like, we can determine a scope to finalize this needed documentation of our analyses and geotechnical design recommendations from additional work completed in 2009, as well as the information your group needs to prepare, if any, design documents that MAE requests moving forward.

This is based on a brief review our files, so let's discuss in more detail as necessary.

Thanks,
Brandon

From: Proskovec, Gary
Sent: Wednesday, February 09, 2011 4:22 PM
To: Desh, Brandon
Cc: Proskovec, Gary
Subject: FW: Port Neal pdf's

Branden,

Looks like Mid-Amer. Energy (Shad Sweeney) has a question about their ponds and conclusions arrived at. Could we talk and then let's give a call to Shad. Been too long since we worked on this totally understand all that he is saying.

Lets discuss tomorrow please.

Thx,

Gary E. Proskovec, PE | Vice President Geotechnical Engineering & Railroad Projects Coordinator

Alfred Benesch & Company
P 402-479-2200 / *Direct:* 402-479-2278 / *Cellular:* 402-560-5222

From: Sweeney, Shad C [mailto:SCSweeney@midamerican.com]
Sent: Wednesday, February 09, 2011 3:37 PM
To: Doland, Frank
Cc: Proskovec, Gary
Subject: FW: Port Neal pdf's

Frank,

If I remember correctly, as a result of the survey of the 3B South pond floor, we were able to raise the maximum pool elevation to 1079.5 from 1079.0.

The original assessment assumed a floor elevation of 1072.5, which resulted in a maximum pool elevation of 1079.0. Then a survey was performed of the pond floor and with the known floor elevation, the maximum pool elevation was calculated to be 1079.5.

I am unable to find documentation confirming my recollection of the above.

If the above statement is correct, could you please confirm?

Thanks,

Shad

From: Frank Doland [mailto:fdoland@hws.com]
Sent: Monday, November 09, 2009 11:48 AM
To: Sweeney, Shad C; Gary Proskovec
Subject: FW: Port Neal pdf's

Gentlemen: This is the same information I sent earlier. Only if you print this topo pdf on an 11"X17" sheet you should be able to read the contour values a little easier.

From: Nate Hanquist
Sent: Monday, November 09, 2009 11:27 AM
To: Frank Doland
Subject: Port Neal pdf's

Attached

Nathan L. Hanquist, P.E.
HWS Consulting Group
P.O. Box 80358
825 J Street
Lincoln, NE 68501-0358
p: 402.479.2250

Solutions Through Service

HWS Consulting Group
825 J Street, Box 80358
Lincoln, NE 68501-0358
402.479.2200 • Fax: 402.479.2276
www.hws.com

August 7, 2009

Ms. Dawn Verros, Senior Buyer
MidAmerican Energy Co.
Neal Energy Center
P.O. Box 778
Sioux City, IA 51102

REFERENCE: Proposal for Geotechnical, Survey, Design, Construction QA/QC Services
Neal North Ash Pond Dike Restorations
MidAmerican Energy Co.
West of Salix, Iowa

Dear Ms. Verros:

HWS Consulting Group Inc. (HWS) is pleased to provide MidAmerican Energy (MAE) a cost proposal for performance of field survey and exploration, soils testing, analysis, design, preparation of plans with accompanying construction specifications, and construction observation services as presented in Mr. Shad C. Sweeney's e-mail of July 30, 2009 (please refer to in Attachment A-1).

SCOPE OF SERVICES

Consistent with MAE's request, HWS is proposing to perform "field" survey, geotechnical engineering, remediation design and engineering services, and construction observation and testing during rehabilitation.

SURVEY:

Survey services would include, but not be limited to, performing the following: A topographic survey would be performed for the outer east and south berms located around Units 3B North and 3B South. In addition, a topographic survey would be performed for that portion of the outer west berm of Unit 1 that has been eroded by sluice waters discharged into the Unit. The topographic survey performed at Unit 1 would extend a minimum of 50 feet south and north of the area requiring reconstruction. The existing internal berms located between Unit 2 and Unit 3A, Unit 3A and Unit 3B South, and Unit 3B North and Unit 3B South would be cross-sectioned at the proposed equalizer culvert locations to assist with the reinstallation of these drainage structures.

The field survey data would be returned to HWS's office to develop cross-sections at each of the equalizer culvert locations. This data combined with the field exploration data obtained will assist in designing the installation of each of the equalizer culverts. The topographic map developed from the field survey will be utilized for stability analyses and assist with the determination of those segments of the Unit 3B North and Unit 3B South outer berms requiring reconstruction and the extent and magnitude of such grading operations.

GEOTECHNICAL EXPLORATION, TESTING, & ANALYSES:

HWS has previously performed twenty-five (25) borings to depths of 5 to 35 feet below existing grade at the referenced site. HWS proposes to make five (5) Dutch friction-cone soundings and seven (7) exploratory borings at the project site. Geotechnical exploratory borings would be performed (1) in the west berm of Unit 1 at the location requiring reconstruction, (2) at each of the three equalizer culvert locations, and (3) at an another location within the outer berm located around Unit 3B South. In addition to the logging of soils encountered at each boring location, field soil testing and soil sampling would be performed.

Disturbed and undisturbed soil samples obtained as part of the geotechnical field exploratory operations would be returned to HWS's office. These soils would be visually classified. Laboratory testing consisting of, but not limited to, the performance of moisture content and density determinations, sieve analysis, Atterberg limit determinations, and shear strength determinations would be performed on the soil samples. This proposal does not include additional triaxial compression tests, but if previously completed shear tests do not represent materials encountered during this investigation, additional triaxial tests may need to be completed. The test data obtained for the soils encountered and from previous soils sampled and tested would be utilized for the performance of slope stability, under seepage, and liquefaction analyses. The geotechnical exploration and lab testing will all be performed in accordance with ASTM standards and procedures.

REMEDIATION DESIGN, PLANS AND SPECIFICATIONS:

The findings of the berm analyses and remediation recommendations produced will be utilized to develop plans and specifications for recommended berm remediation. Plans and specifications will include, but not be limited to, providing grading limits required to provide safe berms, soil types that can be utilized for berm remediation, and berm material placement and compaction requirements.

The findings of the geotechnical exploration, sampling and testing operations performed at the equalizer culvert locations combined with existing culvert information will be utilized to develop plans for the culverts removal and reinstallation. The associated plans and specifications would include addressing the reutilization of existing culverts; the potential need for culvert extensions; the need for the installation of pipe bedding materials; the type of pipe bedding materials required -- - when taking into consideration the water levels that MAE indicates will need to be maintained during the culvert installation; the potential need for granular pipe backfill materials and type, and compaction of culvert bedding and culvert granular and soil backfill materials.

COORDINATION, DESIGN, PRE-BID, CONSTRUCTION PROGRESS AND OTHER MEETINGS:

The proposed services includes coordination of the "field" survey, geotechnical exploration and testing, and construction observation and testing services as well as time to attend a pre-design, interim, and final design, as well as pre-construction, two interim construction progress meetings, and a post-construction meeting for a total of seven meetings throughout the project.

QA/QC, CONSTRUCTION OBSERVATION AND TESTING:

This proposal assumes that fifteen working days would be required to complete the dike restoration for Unit 1 and Unit 3B North and Unit 3B South. Construction observation and testing services have been assumed on a full time basis for fifteen consecutive days. The observation and testing results including an as built survey will be documented in a final report following completion of rehabilitation.

FEE ESTIMATE

HWS' estimate of the scope of work for the geotechnical, survey, and design services described above is provided in Attachments A-2. The total estimated fee for design services shown in Attachment A-2 is $38,344. The scope of construction QA/QC services including as-built survey is difficult to estimate, however, for this proposal HWS' has assumed three weeks of inspection and four construction progress meetings with cost as shown in Attachment A-3. The total estimated fee for construction QA/QC services shown in Attachment A-3 is $27,356. Depending upon the subsurface conditions encountered at the project site and the actual restoration design, either more or less work may be warranted. The charges for additional work performed that has been approved by MAE or the credit for work that did not need to be performed would be computed using the unit rates provided in Attachments A-2 and A-3.

EXECUTION OF CONTRACT

If this fee estimate is acceptable, please sign below and return one copy to HWS. Upon execution and receipt by both parties, this Document shall form an Agreement between MidAmerican Energy Co. and HWS. Services will be performed in accordance with the attached General Conditions.

HWS appreciates having the opportunity to present this proposal. Please contact us at your convenience if any clarification or additional information is required.

Sincerely,
HWS CONSULTING GROUP INC.

Brandon Desh

Brandon Desh, PE

Gary E. Proskovec

Gary E. Proskovec, PE

BLD\bld
Enclosure
52-80-0081: MidAmerican Fly Ash Disposal Pond Additional Services G8-prop.doc
Orig. & 1 pc.: MidAmerican Energy; Attn. Ms. Dawn Verros, Senior Buyer

MIDAMERICAN ENERGY CO.	HWS CONSULTING GROUP INC.
By: ______________________	By: Larry E. Kroskovec
Authorized Signature	Authorized Representative
Title: ______________________	Title: Vice President
Date: ______________, 20____	Date: August 07th, 20 09

HWS Consulting Group Inc.
825 "J" Street, P.O. Box 80358
Lincoln, Nebraska 68501
(402) 479-2200
FAX (402) 479-2276

ATTACHMENT A-1

Gary Proskovec

From:	Sweeney, Shad C [SCSweeney@midamerican.com]
Sent:	Thursday, July 30, 2009 3:03 PM
To:	Gary Proskovec; Frank Doland
Cc:	Verros, Dawn M
Subject:	Request for Proposal - Neal North Ash Pond
Importance:	High

In response to the Geotechnical Engineering Report, *Fly Ash Disposal Pond Containment Assessment,* prepared by HWS, (copies of this report have been sent via mail due to electronic size) MidAmerican Energy is seeking proposals for the following tasks.

<u>Task 1 – Unit #1 Dike Restoration</u>

- Perform a geotechnical investigation, sufficient in scope, to more accurately determine the scope of the repair recommended in section VII of the Geotechnical Engineering Report. It is assumed that additional borings and testing will be required to delineate the boundaries and extent of the repair.
- Prepare a Geotechnical Engineering Report that concisely specifies the results of the investigation and the restoration plan.
- Develop a Technical Bid Specification that defines the recommended scope of repair.
    - Scope of Work, Material Specifications and QA/QC requirements shall be clearly defined.
    - Pricing and payment shall be on a unit price basis.

<u>Task 1A – Unit #1 Dike Restoration QA/QC Services</u>

- QA/QC services and construction observation for the repair. QA/QC services shall include all testing required with a final report documenting construction observations and testing results. This task shall be time and material, not to exceed. It is understood that pricing for this task may not be available until Task #1 is complete.

<u>Task 2 – Unit #3B North and South Dike Restoration</u>

- Perform a geotechnical investigation, sufficient in scope, to more accurately determine the scope of the repair recommended in sections V(A), V(B) and VI of the Geotechnical Engineering Report. Recommended investigation limits are from Section H-H east and north to between Sections L-L and M-M on sheet no. 2 contained in Appendix B of the Geotechnical Engineering Report. It is assumed that additional borings and testing will be required to delineate the boundaries and extent of the repair.
- Prepare a Geotechnical Engineering Report that concisely specifies the results of the investigation and the restoration plan.
- Develop a Technical Bid Specification that defines the recommended scope of repair.
    - Scope of Work, Material Specifications and QA/QC requirements shall be clearly defined.
    - Pricing and payment shall be on a unit price basis.

<u>Task 2A – Unit #3B North and South Dike Restoration QA/QC Services</u>

- QA/QC services and construction observation for the repair. QA/QC services shall include all testing required with a final report documenting construction observations and testing results. This task shall be time and material, not to exceed. It is understood that pricing for this task may not be available until Task #2 is complete.

<u>Task 3 – Equalizing Culvert Elevation Location and Benchmark Specification</u>

- Provide survey services to vertically locate equalizing culverts between Unit #2 and Unit #3A, Unit #3A and Unit #3B South and Unit #3B North and Unit #3B South for maximum pool elevation control in each Unit.
- Provide elevation benchmark design and specification for benchmark placement near equalizing culverts for easy visual verification of pond pool elevation.

ATTACHMENT A-1

A site visit is recommended prior to proposal submittal and can be coordinated with Shad Sweeney (contact information below).

Proposals are due by 1600 CDST on August 5, 2009. Please submit the proposal to Dawn Verros, Senior Buyer MidAmerican Energy, by e-mail at DMVerros@midamerican.com.

Please contact me with any questions regarding this request.

Thanks,

Shad Sweeney
MidAmerican Energy Co.
Neal Energy Center
PO Box 778
Sioux City, IA 51102
Office: 712.277.5288
Fax: 712.277.5274
MidAmerican
ENERGY

Attachment A-2
Scope of Services and Fee Estimate
MidAmerican Energy-North Neal Ash Pond
Geotechnical, Survey, and Design Services

Item No.	Description	Estimated Quantity	Labor Rate or Unit Price	Labor Multiplier	Amount
Geotechnical, Survey, and Design Services					
I.	Survey of Northwest Portion of Unit 1, Units 2 & 3 Berms				
	1. Advanced Survey Technician	24.0 hr.	$ 16.15 /hr.	3.00	$ 1,162.80
	2. Senior Project Survey Consultant	8.0 hr.	$ 38.00 /hr.	3.00	$ 912.00
	3. Senior Project Engineer	4.0 hr.	$ 32.00 /hr.	3.00	$ 384.00
II.	Restoration Design of NW Corner of Unit 1, Units 2 & 3 Berms				
	1. Senior Project Consultant	48.0 hr.	$ 50.33 /hr.	3.00	$ 7,247.52
	2. Senior Project Engineer	80.0 hr.	$ 32.00 /hr.	3.00	$ 7,680.00
III.	Mobilization and Equipment Preparation				
	1. Drill Rig and Crew				
	a. CME 75 Drill Rig	6.0 hr.	$ 75.00 /hr.		$ 450.00
	b. Advanced Driller	8.0 hr.	$ 17.60 /hr.	3.00	$ 422.40
	c. Driller	8.0 hr.	$ 12.45 /hr.	3.00	$ 298.80
	2. Support Vehicle.				
	a. Vehicle Hours	24.0 hr.	$ 4.75 /hr.		$ 114.00
	b. Vehicle Mileage	400 mi.	$ 0.650 /mi.		$ 260.00
IV.	Site Layout, Utility Locate, Water Readings, Cleanup				
	1. Advanced Driller	5.0 hr.	$ 17.60 /hr.	3.00	$ 264.00
	2. Driller	5.0 hr.	$ 12.45 /hr.	3.00	$ 186.75
V.	Drilling and Sampling				
	(Assumes one boring at each Equalizing Culvert)				
	(Assumes two borings for NW Corner of Unit #1 and two borings for Unit 3B-South)				
	1. Dutch Friction-Cone Soundings	85.0 ft.	$ 5.25 /ft.		$ 446.25
	(Four 15-foot-deep and One 25-foot-deep soundings)				
	2. Auger Borings (Hollow -stem auger; 0-50 ft. depth)	85.0 ft.	$ 9.50 /ft.		$ 807.50
	(Four 15-foot-deep and One 25-foot-deep borings)				
	3. Standard Penetration Tests				
	(0-50 ft. depth)	4	$ 24.25 ea.		$ 97.00
	4. Obtaining Undisturbed Soil Samples	12	$ 25.00 ea.		$ 300.00
	5. Hand Auger Borings (2 Locations)				
	a. Advanced Driller	4.0 hr.	$ 17.60 /hr.	3.00	$ 211.20
	b. Driller	4.0 hr.	$ 12.45 /hr.	3.00	$ 149.40
	c. Hand Auger	1 day	$ 14.75 /day		$ 14.75
	6. Motel and Meals				
	a. Motel (2 nights)	Est.	At Cost		$ 300.00
	b. Meals (3 days)	Est.	At Cost		$ 180.00

Attachment A-2
Scope of Services and Fee Estimate
MidAmerican Energy-North Neal Ash Pond
Geotechnical, Survey, and Design Services

Item No.	Description	Estimated Quantity	Unit Price	Labor Multiplier	Amount
VI.	Materials Laboratory Testing				
	1. Soil Density and Moisture Content Determination	12	$ 31.50 ea.		$ 378.00
	2. Soil Moisture Content Determination	4	$ 11.50 ea.		$ 46.00
	3. Liquid & Plastic Limits, and Plasticity index (dry prep	-	$ 83.00 ea.		$ -
	4. Unconfined Compressive Strength of Soil	3	$ 46.00 ea.		$ 138.00
	5. Sand Content (+#200 only)	4	$ 30.50 ea.		$ 122.00
	6. Sieve Analysis (washed - more than 3000 grams)	2	$ 49.50 ea.		$ 99.00
	7. Falling-Head Permeability Test	-	$ 156.50 ea.		$ -
	8. Triaxial Compression of Cohesive Soil,	- pt.	$ 336.00 /pt.		$ -
	Consolidated-Undrained w/ Pore-Pressure (Back-				
	Pressure Saturated); 3 Points Per Envel.				
VII.	Project Meetings, Geotechnical Analysis and Design, and Addendum Report				
	(Assumes Pre-Design, Interim, and Final Design Meetings)				
	(Assumes Geotechnical Analysis at Two Additional Locations)				
	1. Executive Project Consultant	26.0 hr.	$ 52.33 /hr.	3.00	$ 4,081.74
	2. Senior Project Consultant	24.0 hr.	$ 50.33 /hr.	3.00	$ 3,623.76
	3. Senior Berm Design Project Consultant-	8.0 hr.	$ 50.00 /hr.	3.00	$ 1,200.00
	3. Project Engineer	64.0 hr.	$ 30.00 /hr.	3.00	$ 5,760.00
	4. Advanced Clerical Assistant	2.0 hr.	$ 18.00 /hr.	3.00	$ 108.00
	5. Vehicle				
	a. Vehicle Hours	24.0 hr.	$ 4.75 /hr.		$ 114.00
	b. Vehicle Mileage	900 mi.	0.650 /mi.		$ 585.00
VIII.	Reimbursable Expenses and Equipment				
	Photocopies, Postage, Facsimiles, etc.	Estimated Amount			$ 200.00
		Estimated Design Total:			**$ 38,344**

Attachment A-3
Scope of Services and Fee Estimate
MidAmerican Energy-North Neal Ash Pond
Construction Observation and QA/QC Services

Item No.	Description	Estimated Quantity	Unit Price	Labor Multiplier	Amount
Construction QA/QC Services					
I.	QA/QC Services, Construction Observation and Final Construction Report				
	(Assumes Three Weeks of Full Time Construction Observation Services)				
	(Assumes Three Construction Progress Meetings and a Post Construction Meeting)				
	1. Executive Project Consultant	4.0 hr.	$ 52.33 /hr.	3.00	$ 627.96
	2. Senior Project Consultant	35.0 hr.	$ 50.33 /hr.	3.00	$ 5,284.65
	3. Project Engineer	46.0 hr.	$ 30.00 /hr.	3.00	$ 4,140.00
	4. Advanced Technician	150.0 hr.	$ 17.25 /hr.	3.00	$ 7,762.50
	5. Advanced Clerical Assistant	2.0 hr.	$ 18.00 /hr.	3.00	$ 108.00
	6. Nuclear Density Gauge Rental	150.0 hr.	$ 9.00 /hr.		$ 1,350.00
	7. Moisture-Density Curve	2.0	$ 132.00 ea.		$ 264.00
	6. Vehicle				
	a. Vehicle Hours	182.0 hr.	$ 4.75 /hr.		$ 864.50
	b. Vehicle Mileage	1800 mi.	0.650 /mi.		$ 1,170.00
	7. Motel and Meals:				
	a. Motel (12 nights)	Est.	At Cost		$ 900.00
	b. Meals (Fifteen days)	Est.	At Cost		$ 450.00
II.	As-Built Survey of Northwest Portion of Unit 1, Units 2 & 3 Berms				
	1. Advanced Survey Technician	24.0 hr.	$ 16.15 /hr.	3.00	$ 1,162.80
	2. Senior Consultant	8.0 hr.	$ 50.33 /hr.	3.00	$ 1,207.92
	3. Senior Project Survey Consultant	8.0 hr.	$ 38.00 /hr.	3.00	$ 912.00
	4. Senior Project Engineer	12.0 hr.	$ 32.00 /hr.	3.00	$ 1,152.00
	Estimated Construction Total:				**$ 27,356**

ASH POND OPERATION AND MAINTENANCE PLAN

MidAmerican Energy Company

Neal North Energy Center

1151 260th Street
Sergeant Bluff, Iowa 51054

Prepared by

Jeff Schultzen, Senior Environmental Coordinator
Sam Nelson, Manager – Environmental Health and Services

DATE: 2/21/2011

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Appendices

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Appendix C: Annual Inspection Form
Appendix D: Maintenance Log Form
Appendix E: Site Map
Appendix F: Contact List
Appendix G: Pond Height Elevation Sheet

Section 1.0 General Information

1.1. Purpose / Plan Overview

This plan provides guidance on evaluating berm safety, berm integrity and performing berm inspections on the Neal North Energy Center ash pond system. The plan also provides guidance on identifying and reporting berm deficiencies and issues that are noted during inspections.

The purpose of this plan is to ensure all aspects of berm management are covered including; who will be performing the inspections, how are they performed and what to do when deficiencies are noted.

1.2 Safety

Inspection of the berms and ponds requires activities posing potential safety hazards to personnel involved. At no time should inspection activities take precedent over personal safety.

The banks of the roads used to access the ash pond area have steep slopes. Employees driving on the berm access road should keep their eyes on the road way when driving and come to a complete stop prior to conducting any inspections of the ponds and berms. Slippery conditions, tripping hazards and holes may exist around the pond when walking the toe and banks of the berm. These conditions warrant caution when conducting inspection activities.

Winter Weather conditions can also pose other safety hazards as well. At times, heavy precipitation, extremely cold temperatures and dangerous wind chills can all pose a threat when out in the ash pond area. Access roads may become drifted with snow, causing difficult driving conditions. Snow cover can also blanket the road making it difficult to determine where the road ends and ash pond begins. Extreme temperatures and wind chills can also be very dangerous if plant personnel become stranded in the pond area. A good safety measure to use when completing inspections in the winter is to take some form of communication device with you including but not limited to; cell phones or radios.

1.3 Environmental

When operating vehicles on unpaved roads all employees share the responsibility for regulatory compliance and procedural conformance concerning fugitive dust emissions. When operating vehicles on unpaved roads, observe plant speed limits and check for fugitive dust emissions. If fugitive dust emissions are observed, reduce speed. If conditions warrant, contact Headwaters Inc. (Appendix E) to spray water on roads to control fugitive dust.

1.4 Definitions

Upstream Slope (Inner Face) - inclined surface of the dam that is in contact with the reservoir. The upstream slope of an embankment dam must be protected from the erosive action of waves. Erosion protection may include vegetation, the placement of riprap or some other slope protection material, or the configuration of the slope.

Downstream Slope (Outer Face) - inclined surface of the dam away from the reservoir. The downstream slope also requires some form of protection from the erosive effects of surface runoff. Grass or rock is often used for erosion protection on the downstream slope.

Crest and Shoulders - top surface of the dam. A roadway is often established across the crest for traffic or to facilitate dam operation, inspection and maintenance. Shoulders are the intersection of the crest with the upstream and downstream slopes.

Downstream Toe (Outer Toe) - junction of the downstream slope of the dam with the ground surface.

Abutment - part of the valley side against which the dam is constructed. The contact between the abutment and the embankment slope is called the embankment-abutment contact. Embankment-abutment contacts are also referred to as groins.

Reservoir - body of water impounded by a dam.

Outlet Works - structures through which normal reservoir releases are made. Outlet works can also be used to drain the reservoir. Outlet works can either be conduits which pass through the embankment or its foundation, or tunnels which are excavated through abutment rock.

Cracks - indicate a differential movement of the berm. Settlement of an earthen embankment indicates either the loss of material from the embankment, or additional compression of the embankment or foundation materials. Both conditions are indicators of embankment instability.

Transverse cracks - appear across the embankment and indicate differential settlement within the embankment. Such cracks provide avenues for seepage water and piping could develop quickly.

Longitudinal cracks - parallel to the embankment and may signal the early stages of a slide or slump on either face of the embankment. In recently built structures, these cracks may indicate inadequate compaction of the embankment during construction.

Sinkholes - formed when the removal of subsurface embankment or foundation material causes overlying material to collapse into the resulting void. The presence of a sinkhole may indicate that material is being or has been transported out of the dam or foundation through the process of internal erosion or piping. The decomposition of buried wood or other vegetative matter, and animal burrows can also cause sinkholes.

Depression - a form of settlement in the embankment or foundation that is less serious than a sinkhole. Depressions are caused by erosion, wave action against the upstream slope that removes embankment fines or bedding from beneath riprap, localized settlement in the embankment due to poor compaction or foundation due to compressible materials and loss of sub-surface material through the decay of vegetative matter, or through internal erosion or piping.

Slides / slumps - A massive slide can initiate catastrophic failure of a berm. Slides can be detected easily unless obscured by tall vegetation. Arc-shaped cracks are indications that a slide or slump is beginning. These cracks soon develop into a large scarp in the slope at the top of the slide.

Settlement - occurs both during construction and after the embankment has been completed and placed in service. To a certain degree, this is normal and should be expected. It is usually most pronounced at locations of maximum foundation depth or embankment height. Excessive settlement will reduce the freeboard (the difference in elevation between the water surface and the top of the dam) and may increase the probability of overtopping. A bulge in the embankment indicates that settlement has occurred.

Erosion - a natural process of continual forces that wear down surfaces or structures. Erosion can be caused or aggravated by improper drainage, settlement, pedestrian traffic, inadequate vegetation, animal burrows, or other factors. The cause of the erosion will have a direct bearing on the type of repair needed. Erosion in and around dams can lead to failure of a dam if left untreated. Erosion areas should be documented with stakes and photographs. There are two types of erosion beaching and surface runoff.

Wave Action Erosion (Beaching): Wave action erosion causes the removal of a portion of the upstream slope of the embankment. When this occurs, embankment material is deposited farther down the slope. In this form of erosion, the slope protection (i.e., riprap or vegetative cover) and underlying material are removed. A relatively flat beach area with a steep back slope or scarp is formed. On smaller dams, wave action erosion could lessen the width of the embankment, possibly leading to increased seepage, instability, or overtopping of the dam. Ice action on the upstream slope can also lead to the removal or displacement of the slope protection.

Surface runoff erosion: is one of the most common maintenance problems of embankment structures. Bald areas or areas where the protective cover is sparse are more susceptible to surface runoff erosion problems. The worst damage from surface runoff is manifested by the development of deep erosion gullies on the slopes, both at the groins and in the central portion of the dam.

Riprap - is broken rock or boulders placed on the upstream and downstream slopes of embankment dams. Riprap provides protection from erosion caused by wind or wave action, surface runoff erosion, and wind scour. Properly designed upstream riprap slope protection is made up of at least two layers of material:

Seeps – occur when water from impoundment flows through embankment / berm and exits the downstream side of the berm.

Piping - occurs when reservoir water moving through the pores of the dam or foundation soil (i.e., seepage) exerts attractive force on the soil particles through which it is flowing, sufficient to remove them at the seepage exit point. In a piping failure, the pipe continually enlarges as erosion removes soil adjacent to the pipe. Usually the overlying embankment eventually collapses causing a breach of the dam.

Sand boil is the circulation of fine cohesion less superficial soil in a "boiling action" due to high seepage exit velocity. Sand boils may indicate that piping is occurring. If exiting seepage is cloudy or turbid, it is an indication that fines are being removed with the exiting seepage. The formation of a deposition cone around the seepage exit or sand boil is further indication that piping is taking place.

Ruts – cuts developed in crest of berm, typically from vehicle traffic over wet surfaces. Water collected in ruts may cause localized saturation thereby weakening the embankment.

Section 2.0 Ash Pond System Description

The Neal North ash pond system consists of four different ash ponds. Ash disposal unit 1 (Neal 1 Slag Pond) consist of only Neal 1 bottom ash. No other waste stream flows into this pond. It should be noted that there is rarely any standing water in this pond except for periods of heavy rainfall. This pond does not have a discharge point.

Ash disposal units 2, 3A and 3B make up the other portion of the ash pond system. These ponds are all interconnected and have a common discharge point which is located in ash disposal unit 3B (See Appendix D). Flyash from Unit 1 and flyash/ bottom ash from Unit 2 is discharged into ash disposal unit 2 along with the plant site drain wastewater. The water flows by gravity to ash disposal unit 3A and then to 3B where it commingles with flyash and bottom ash sluice water from Unit 3. All wastewater is discharged through Outfall 003 of the Neal North NPDES permit # 9700102.

There are two separate berm structures that shall be inspected. Pond unit 1 is a separate berm structure. Pond unit 2 consists of ash disposal units 2, 3A and 3B and is considered to have one outer berm structure. There are several internal berm structures within pond unit 2 to assist with the operations of the pond unit.

Freeboard – See Pond Height Elevation Sheet in Appendix F for maximum pond height operating elevation. A vertical freeboard of three feet above the water level is essential to prevent overflow from an extreme rainfall.

If the operating water level is greater than the maximum operating height, check the outlet pipe for any blockage and notify the shift supervisor **<u>immediately</u>**.

Section 3.0 Pond Management / Operation

3.1 Fly Ash Disposal Pond Containment Assessment

HWS Consulting Group (HWS) of Lincoln, Nebraska was contracted by MidAmerican Energy Company (MidAmerican) to conduct a geotechnical investigation and analysis of the Neal North fly ash disposal pond containment structures. The geotechnical field exploration, laboratory soils testing, analysis, and assessment included the following:

1. Review of original design plans and project specification that were developed between 1960 and 1975 and made available to HWS.
2. Performing field survey to establish current configuration of dikes at potential assessment locations.
3. Geotechnical exploration and laboratory soils testing.
4. Presenting slope stability, seepage failure, and liquefaction analyses findings.
5. Consultation with MidAmerican Energy engineering personnel to assess the operating conditions such as maximum pool elevations and fly ash containment heights for all three units' ponds.
6. Discussion on the condition of the existing dikes and recommended berm remedial measures.
7. Recommendations for satisfactory future operation of the ash pond dike system.

Field work for the evaluation was completed in late April and early June 2009.

MidAmerican requested that HWS complete the evaluation of the ponds using standard industry techniques and specifically provide the safe operating conditions, primarily pool elevation, for each area of the pond system based upon current site conditions. With the original top elevation of the ash pond dikes at 1085 feet it was considered reasonable to operate the ponds as high at 1082 feet allowing 3 foot of freeboard. If the safe pool elevation is less than 1082 feet based upon current site conditions, HWS was to provide recommendations for the specific areas that would safely allow operation at a pool elevation of 1082.

The final geotechnical report was issued by HWS on September 10, 2009. A summary of the current site operation conditions is as follows:

Ash Disposal Unit Number	Maximum Operating Pool Elevation (ft)	Minimum Unit Floor Elevation after Excavation
1	1078.5	1074
2	1082	1072.5
3A	1082	1072.5
3B - North	1082	1072.5
3B - South	1079.5	1074

These numbers are the basis for the maximum pond elevations and maximum excavation depths discussed in the following sections. Recommendations for increasing the pool elevations in the ponds currently limited below 1082 feet are currently under engineering review.

3.2 Pond Inventory

As discussed in the previous section, Neal 1, 2, and 3 all discharge ash sluice water and ash to the ash pond system. All of the Neal 1 ash is sluiced to the ash ponds. For Neal Unit 2 and Unit 3 only the bottom ash and economizer ash is sluiced to the ponds. Although there is a back-up system that can sluice the fly ash to the ash ponds, the majority of fly ash is collected dry from the precipitator and stored in the dry fly ash silo for sale for beneficial use.

For Unit 1 all of the ash generated is handled wet and sluiced to the ash ponds. The bottom ash or slag is sluiced to the Neal 1 pond. The amount of slag transferred to the pond is approximately 80% of the total of the ash which is approximately 20,000 tons per year. Neal 1 is a cyclone fired boiler and as a result the majority of the ash is produced as slag. The remaining 20% or 5,000 tons per year is produced as economizer and fly ash and is sluiced wet to the western portion of the Neal 2 pond.

Neal Unit 2 and Unit 3 are both pulverized coal fired boilers. Ash production from a pulverized coal boiler generally results in the fly ash produced to be approximately 80% with the economizer ash and bottom ash making up the remaining 20%. Both Unit 2 and Unit 3 were retrofitted with dry fly ash handling systems in the early 1980s. The wet fly ash system for each unit was left in place and is available as a backup for the dry fly ash system. On average Neal 2 generates about 10,000 tons of bottom ash and economizer ash that is sluiced to the ash ponds. Normally Neal 3 generates about 25,000 tons of bottom ash and economizer ash that is sluiced to the ash ponds. Both the Neal 2 and Neal 3 numbers contain a small amount of fly ash that is discharged to the ash ponds when the wet fly ash system is used during unit restart or as a back up to the dry fly ash system. The total ash discharged to the ash ponds is approximately 60,000 tons per year.

Since the ponds have a limited capacity, some sections of the ash ponds are excavated annually while some other areas of the ponds are excavated approximately every 2 to 3 years. The contract that MidAmerican Energy has with the current ash marketing company requires that an inventory of the ash ponds be kept and the ash marketing vendor is required to maintain the ash pond inventory at the same level it was at the time of contract signing. A spreadsheet is used to track the pond inventory. Input data to the spreadsheet includes all of the scale data provided by the ash marketing vendor for selling and disposal of ash products. The total tons of ash produced is calculated by multiplying the total tons coal burned by the ash content on a monthly basis. The sum of the ash products sold and disposed is then subtracted from the total ash produced to provide the tons of ash disposed in the ash ponds. This is the amount that the ash marketing vendor is required to remove on an annual basis. Balances are brought forward from the previous year, both positive and negative, to maintain an accurate accounting of the obligation of the ash marketing vendor.

3.3 Verification of Pond Water Levels

As identified in Section 3.1 above there are specific limits for the pool (pond) elevation in the various sections of the ash pond system. The current invert elevation of each culvert in use between the ash pond sections is 1080 feet. Using these elevations along with knowing the pipe diameters of each pipe (2 feet), a verification that the water level in each of the ponds is below the levels recommended in the HWS study can be made. Observer shall note if inlet of each pipe listed in the weekly ash pond inspection form is submersed. Anytime any portion of the pipe is out of the water; elevations are below the recommended maximum level. Readings will be logged on the weekly ash pond inspection form, located in Appendix A.

3.4 Excavation Practices

The fly ash disposal pond containment assessment determined that the original ash pond dikes had ash materials placed immediately inside the original dikes and in some cases on top of the existing dikes. In some locations it is difficult for the casual observer to determine the exact location of the centerline of the original dike. For this reason MidAmerican has taken a very conservative approach to excavation near the outside original dikes. The study indicated that excavation should not take place within 50 feet of the center line of the original dike. MidAmerican will limit excavation so that it will not take place within 100 feet of the apparent centerline of the original dike location. This approach will provide an additional margin of safety to prevent accidentally digging too close to the original dike.

Maximum depths for excavation for each of the ash pond areas have also been established in Section 3.1 above. In general these maximum excavation depths are equivalent to the original bottom of the ash pond when the ponds were first excavated during original construction and are therefore equal to the bottom of the original constructed dike. Digging below this level dramatically increases the risk of dike failure. If there are other factors that act to weaken the dike, such as the height of the existing dike being lower than the original height, the maximum depth of excavation will be raised to compensate for that deficiency. The excavation depths listed in Section 3.1 above are not to be exceeded during pond excavation.

3.5 Stock Pile of Ash

Ash excavated from the ash ponds may be stock piled within the operating limits of the ash ponds for later use. Care should be taken not to stock pile ash in areas that may lead to damage to the original ash pond dikes. New stockpiles of excavated ash should not be placed within 100 feet of the original ash pond dikes. Existing stock piles of ash that are within 100 feet of the original ash pond dikes that are not causing damage to the original dikes do not need to be removed. Where possible, excavated materials should be stockpile in the central areas of the ash ponds.

Section 4.0 Inspections and Recordkeeping

4.1 Inspection Guidelines

4.1.1 Reference Convention

Convention dictates that when you refer to right or left on a dam, your perspective should always be facing downstream (with the reservoir behind you). For example, the right abutment would be on your right-hand side when you are standing on the crest looking downstream.

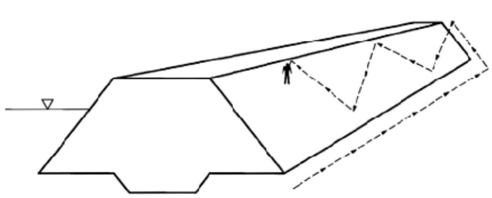
4.1.2 Conducting the Inspection

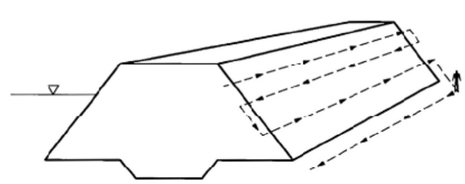
It is helpful to prepare an inspection route in advance to assure that every part of the berm will be observed. The following is a recommended sequence to assist in your inspection:

- UPSTREAM/DOWNSTREAM SLOPE - Walk across the slope in a parallel or zigzag pattern from abutment to abutment. From a given point on the slope, you can usually see small details for a distance of 10 to 100 feet in each direction, depending on the roughness of the surface, vegetation, and other surface conditions.
- CREST - Walk across the crest from abutment to abutment. Inspecting the crest is similar to inspecting the slopes. You can use either a zigzag pattern or a parallel pattern to inspect the crest. View the crest from many different perspectives. Some deficiencies can be spotted close up, while other deficiencies can be observed only from a distance.
- EMBANKMENT-ABUTMENT CONTACTS - Walk the entire length of the embankment-abutment contacts (groin).
- OUTFALL/VALVES - Observe all accessible features.
- DOWNSTREAM CHANNEL - Travel the route of the stream below the dam to maintain familiarity with locations of residences and property which can be affected by dam failure.
- DOWNSTREAM TOE - Walk the entire length of the downstream toe.

4.1.3 Techniques

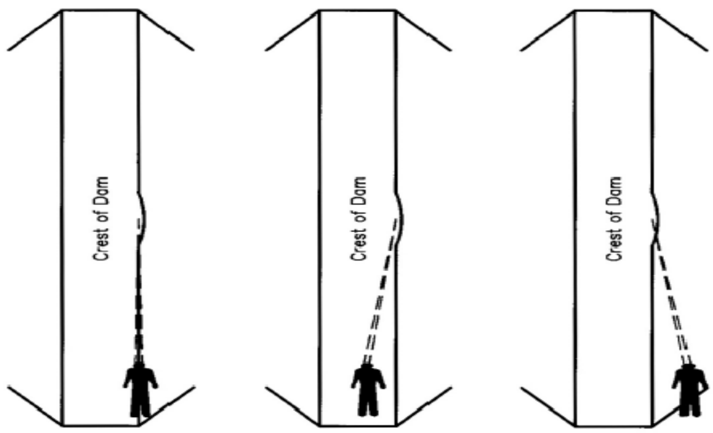
Parallel or zigzag pattern - Both of these techniques are acceptable methods for walking the dam slopes and crest. Remember, the goal is to be able to see the entire surface of the embankment clearly. Reaching this goal may require that you walk the surfaces several times.





Zigzag Pattern Parallel Pattern

Sighting - When checking the alignment of the crest and any berms on the upstream and downstream slopes, a useful sighting technique is to center your eyes along the line being viewed and move from side to side in order to view the line from several angles.



In sighting along the crest, you need to view your chosen reference line from a number of different perspectives. First sight on a direct line; then move to either side. The sighting technique is useful for detecting a change in the uniformity of the slope. The contact between the reservoir waterline and the upstream slope should parallel the alignment of the dam axis. In other words, the reservoir waterline should be a straight line if the dam has a straight axis.

4.2 Inspection Frequency

4.2.1 Operational Inspections - Regular operational inspections are typically conducted by members of the plant EHS department. These inspections involve visual inspection of the berm, along with the recording of data obtained from staff gauges or other instrumentation on-site. Laboratory technicians will drive the berm of the ponds at least weekly and document any observations noted on the weekly inspection checklist found in Appendix A. A monthly inspection will be completed by a member of the EHS department. This includes driving the perimeter of the ponds and recording observations identified on the form found in Appendix B. A more detailed ash pond inspection will be completed on an annual basis by a member of the EHS department and an engineer familiar with the dike embankments and associated engineering data collected during studies of the embankments. This inspection includes both a driving and walking inspection of the berms and completion of the annual inspection form in Appendix C.

4.2.2 Engineering Inspection - The engineering inspection consists of a thorough evaluation of the structural and hydraulic condition of the berms and includes an internal inspection of the outlet structure. These inspections will be conducted by a licensed professional engineer experienced in dam construction and design. Engineering inspections will be conducted every five years. The Environmental Coordinator will be responsible for ensuring this inspection is completed and all documentation is filed.

4.3 Record Retention

All records of inspections, maintenance logs and other supporting documentation shall be kept for a minimum of 3 years or longer if directed otherwise.

Section 5.0 Berm Maintenance

5.1 Vegetation Control

Vegetative cover for berm embankments should consist of a suitable growth of grass, a well-established cover of grass provides satisfactory crest and downstream slope protection. The grass cover should be maintained to a maximum height of approximately six inches to allow proper embankment inspection. In addition, well-maintained grass helps prevent animal burrowing and controls deep-rooted vegetation.

Bare embankment slopes are susceptible to erosion, and the presence of cattails and other water-loving vegetation is often indicative of a high water surface or seepage within the embankment. Tree and brush growth on embankments is also undesirable, as it provides cover for burrowing animals; prevents a thorough inspection of the embankment; provides an avenue for seepage as roots decay; and if trees tip over during windstorms, the loss of soil around the root mass can compromise the integrity of the embankment.

5.1.1 Mowing

Mowing on all outer berm walls and crest will be completed as needed to enable proper inspection and maintenance activities to continue throughout the year. Mowing will be completed by a contractor and dates the mowing activities take place will be documented on the Maintenance Log of Events sheet included in Appendix C.

5.1.2 Reseeding

Reseeding of berms and crests will take place anytime soil is disturbed or vegetation is lost due to construction or berm management activities. Proper soil erosion control techniques will be used to ensure any erosion is minimized. Erosion control activities may include but not limited to straw cover, silt fences and bale checks. All erosion control devices must be maintained and kept onsite until vegetation has regained control of the site. Reseeding shall be documented on the Maintenance Log of Events sheet in Appendix C.

5.1.3 Woody Vegetation Control

Mowing activities should control most Woody vegetation. In those instances that mowing does not inhibit the growth of woody vegetation, a contractor may be used to remove the woody vegetation from the berm or embankment. If trees and shrubs will re-sprout after being cut, a licensed contractor shall be used to apply an inhibitor onto the stumps of trees and shrubs that have been cut to prevent re-growth.

5.1.4 Spraying

In instances when mowing is not effective means of keeping weeds and unwanted vegetation from growing on berms and crest of the ash pond area, a licensed contractor shall be used to spray for weeds and unwanted vegetation. Certain weeds destabilize the berm by acting like woody vegetation. Root masses are less prevalent and density of cover is much less than typical grass covers allowing for open soil areas that may be exposed to erosion. Weeds often grow much quicker than grasses and will inhibit berm inspections from being completed effectively.

5.2 Berm Structural Control

Structural integrity of the berms is maintained by ensuring deficiencies noted during routine operational and engineering inspections is taken care as efficiently as possible. Small burrows, rutting, surface erosion and other minor deficiencies can be repaired by plant staff or onsite contractor.

If major structural deficiencies are noted, an engineering firm should be brought in to analyze the berm stability and develop a plan for restoration of the berm area. All maintenance activities associated with structural restoration must be logged into the Maintenance Log of Events sheet.

Section 6.0 Security

The Neal North facility is staffed with Security personnel 24 hour/day, 7 days per week. Security personnel make daily rounds out in the ash pond area. The access gate from Port Neal Circle is locked closed during evening hours, weekends and holidays. The second access point to the ash pond area is through the plant. Access to the plant must be granted by an MEC employee before anyone outside the company can gain access to the site.

Appendix A

Weekly Inspection Form

	3B Weir Box Water Elevation (Feet)	Culvert 1 (Pond 2 to 3A)	Culvert 2 (Pond 3A to 3B)	Culvert 3 (Pond 3B North to 3B South)
Date	**Recommended Level >/= 5.5 Feet**	**Is Culvert Submersed?**	**Is Culvert Submersed?**	**Is Culvert Submersed?**

Form: Ash Pond Berm Operation and Maintenance Plan Rev. 12.7.2010 JGS
***Please return completed form to Environmental Coordinator for review and filing. ***

Appendix B

Monthly Inspection Form

(Insert Inspection Form)

Monthly Coal Combustion Ash Pond Dam Inspection

Owner:	MidAmerican Energy Company	Inspector's Name:
Faciltiy:	Neal North Energy Center	Date:
Unit I.D.:	Neal 1, 2 & 3 Ash Ponds	Inspector's Signature:

	Yes	No
Driving inspection of all outer ash pond dikes:		
1.0 Are the tops of the dikes free of cracks or settlement?		
2.0 Is there erosion visible on the outside slopes of the dikes?		
3.0 Is there erosion visible on the inside slopes of the dikes?		
Pond Elevations:		
4.0 Pond 1. Water level is below safe elevation as indicated on elevation marker?		
5.0 Pond 2 to Pond 3A		
5.1 Is water flowing freely?		
5.2 Is water level in culvert less than or equal to 2 feet above the upstream pipe invert elevation?		
6.0 Pond 3B North to Pond 3B South		
6.1 I water flowing freely?		
6.2 Is water level in culvert less than or equal to 2 feet above the upstream pipe invert elevation?		
7.0 Pond 3A to Pond 3B South		
7.1 I water flowing freely?		
7.2 Is water level in culvert less than or equal to 2 feet above the upstream pipe invert elevation?		

Discharge Elevations:	Record Level
8.0 Record 3B South Pond Elevation at Discharge Structure	
9.0 Record Discharge Level at Discharge to River	

Note Section (list Inspection number first):

Appendix C

Annual Inspection Form

(Insert Inspection Form)

Annual Coal Combustion Ash Pond Dam Inspection

Owner:	MidAmerican Energy Company	Inspector's Name:	
Facilty:	Neal North Energy Center	Date:	
Unit I.D.:	Neal 1 Ash Pond	Inspector's Signature:	

	Answer	Yes	No		Answer	Yes	No
1. Date of ash pond dike inspections				**14**. Major erosion or slope deterioration?			
2. Pond Elevation (weir box reading)				**15**. Decant Pipes:			
3. Drainage ditch normal elevation				**15a**. Is water entering inlet, but not exiting outlet?			
4. Location of lowest ash pond dike crest elevation				**15b**. Is water exiting outlet, but not entering inlet?			
5. Is embankments under construction?				**15c**. Is water exting outlet flowing clear?			
6. Are trees growing on embankment?				**16**. Seepage occuring from locations listed below:			
7. Any cracks or scarps on crest?				**16a**. Isolated points on embankment slopes?			
8. Is there significant settlement along crest?				**16b**. Natural hillside in the embankment area?			
9. Are there depressions or sinkholes in tailings surface or whirlpool in pool area?				**16c**. Over a widespread area?			
10. Are spillways, groins, ditches clogged with debris?				**16d**. Around the outside of the decant pipe?			
11.Are outlets of decant of underldrains blocked?				**17**. Surface movements in valley bottom or hillside			
12. Are there cracks or scarps on slopes?				**18**. Water against downstream toe?			
13. Is there sloughing or bulging on slopes?				**19**. Were photos taken?			

Attention: Major adverse changes in any of these items could cause instability of dike structure and should be reported immediately. Abnormal conditions should be described in the notes section.

Note Section (list Inspection number first):

Annual Coal Combustion Ash Pond Dam Inspection

Owner:	MidAmerican Energy Company	Inspector's Name:	
Faciltiy:	Neal North Energy Center	Date:	
Unit I.D.:	Neal 2 & 3 Ash Ponds	Inspector's Signature:	

	Answer	Yes	No		Answer	Yes	No
1. Date of ash pond dike inspections				**14**. Major erosion or slope deterioration?			
2. Pond Elevation (weir box reading)				**15**. Decant Pipes:			
3. Drainage ditch normal elevation				**15a**. Is water entering inlet, but not exiting outlet?			
4. Location of lowest ash pond dike crest elevation				**15b**. Is water exiting outlet, but not entering inlet?			
5. Is embankments under construction?				**15c**. Is water exting outlet flowing clear?			
6. Are trees growing on embankment?				**16**. Seepage occuring from locations listed below:			
7. Any cracks or scarps on crest?				**16a**. Isolated points on embankment slopes?			
8. Is there significant settlement along crest?				**16b**. Natural hillside in the embankment area?			
9. Are there depressions or sinkholes in tailings surface or whirlpool in pool area?				**16c**. Over a widespread area?			
10. Are spillways, groins, ditches clogged with debris?				**16d**. Around the outside of the decant pipe?			
11.Are outlets of decant of underldrains blocked?				**17**. Surface movements in valley bottom or hillside			
12. Are there cracks or scarps on slopes?				**18**. Water against downstream toe?			
13. Is there sloughing or bulging on slopes?				**19**. Were photos taken?			

Attention: Major adverse

Note Section (list Inspection number first):

Appendix D

Maintenance Log of Events

Date	Routine/ Emergency	Maintenance Action Performed	Contractor Name	Signature of Responsible Employee

Appendix E
Aerial Photo

Appendix F
Plant Contacts

Name	Title	Daytime Number	Night Number	Cell Number
Reg Soepnel	General Manager	(712) 277-5222	(712) 266-5739	(712) 266-5739
Brad Lewis	Unit Manager-Operations	(712) 277-6331	(712) 943-8534	(712) 251-7009
Mark Skinner	Unit Manager-Maintenance	(712) 277-6323	(712) 943-3411	(712) 490-5207
Dale Norton	Assistant Unit Manager-Operations	(712) 277-6383	(402) 404-8248	(712) 204-2854
Marc Fracisco	Assistant Unit Manager-Maintenance	(712) 277-6342	(712) 899-6162	(712) 899-6162
Sam Nelson	Manager - Environmental Health & Services	(712) 277-5287	(712) 943-9123	(712) 541-1451
Jeff Schultzen	Senior Environmental Coordinator	(712) 277-5232	(712) 873-5950	(712) 301-1542
Tom Dalke Hank Glisar Gary Haight Marc Rosenholtz Bill Brown Paul Licht	Shift Supervisors	(712) 277-5218		
MEC Substations, MEC Gas Department	Internal Emergency Facilities Line	1-800-622-1003		
Adam Chandler	Headwaters Resources Inc.	Office: 943-5247 Cell: (712) 216-0388		

Appendix G

Pond Height Elevation Sheet

The concrete platform at the pond where sluice gate 1 (SG1) is located is elevation 1084.86 feet. This was surveyed in August of 2009 by DGR Company. Elevation was written on concrete pad. Pond height elevations can be figured by taking a height reading on the weir box and using the conversion table below.

Pond Height Reading	Pond Elevation (Feet)
Concrete Pad	**1084.86**
2	**1082.86**
2.5	**1082.36**
3	**1081.86**
3.5	**1081.36**
4	**1080.86**
4.5	**1080.36**
5	**1079.86**
5.5	1079.36
6	1078.86
6.5	1078.36
7	1077.86
7.5	1077.36
8	1076.86

Note: Numbers in red indicate water height over the engineering study recommended level. Please inform **Jeff Schultzen or Sam Nelson** if the level reaches the 5.5 foot mark.

WSEC Surface Impoundment Inspection Form

Circle one: North Surface Impoundment South Surface Impoundment

Inspector's Name: ____________________________ Date: _________________

Answer each question as "Yes" or "No". All "No" answers must be explained below with how the deviation will be remedied.

	Yes	**No**
Is the top of the dike free of cracks or settlement?		
Is the wall/slope of the dike free of cracks or erosion?		
Is the dike free of visible signs of seeps or leaks? *Inspect entire slope, inlet and outlet piping, and "boils" from beneath a stream or pond, as applicable.*		
Is the ash surface free of depressions, sinkholes or whirlpools?		
Is the top of the dike free of trees and large vegetation?		
Is the slope of the dike free of trees and large vegetation?		
Are fugitive dust emissions under control?		
Is the north surface impoundment near the level of discharge at Outfall 006? *If yes, provide estimated level to discharge in box below.*		
Is there at least two feet of freeboard at the lowest point of the levee crest?		
Is levee toe free of signs of erosion? *Look for signs of wave action.*		

Explanation for "No" answers, include expected repairs and work order numbers:

Other comments:

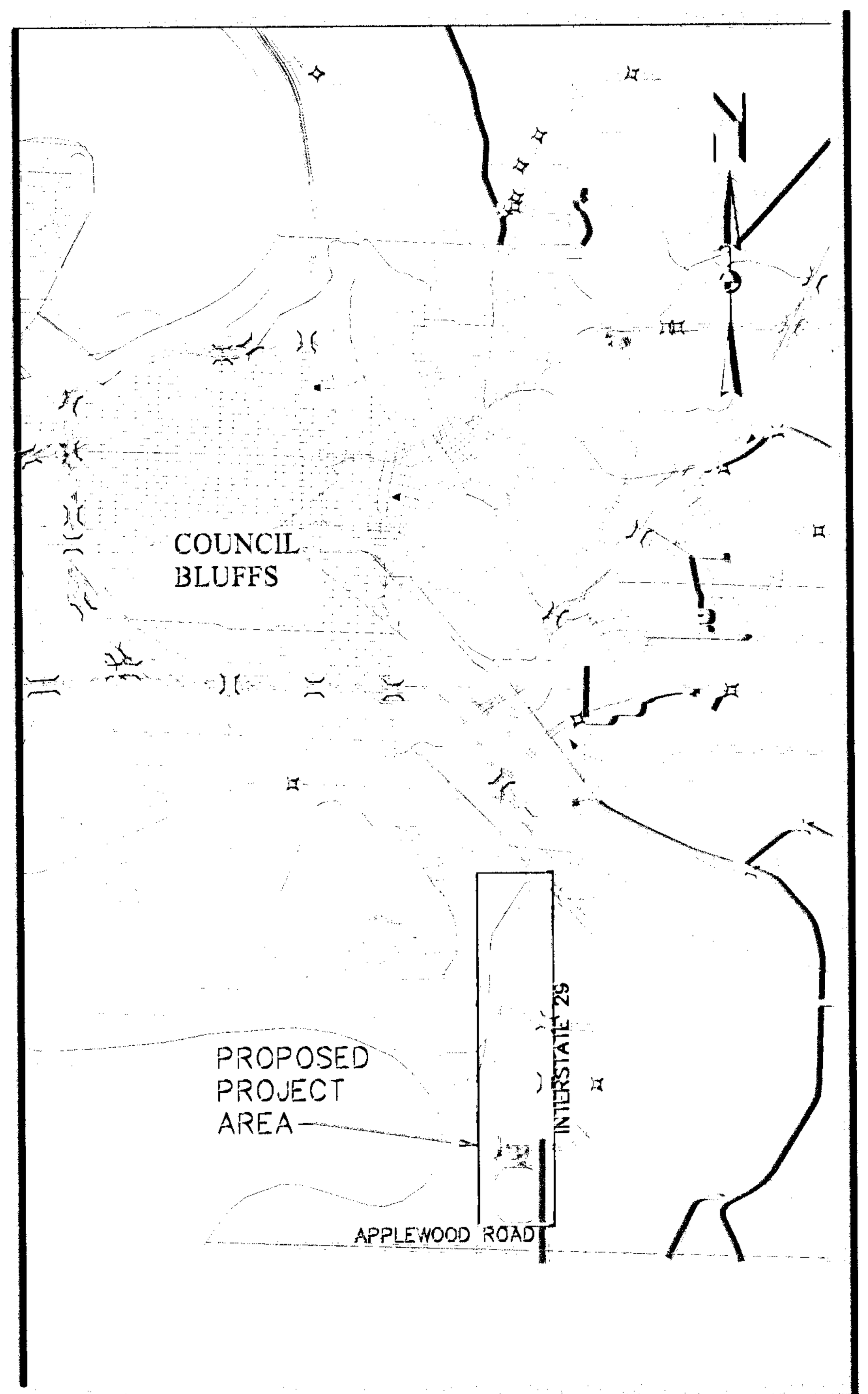
____

____

____

Inspector signature: ___________________________________

SOUTHWEST IOWA RENEWABLE ENERGY, LLC
ETHANOL PLANT
RAIL SPUR AND STORAGE LOOP
RAIL CONSTRUCTION CONTRACT
COUNCIL BLUFFS, IOWA



LOCATION MAP
NO SCALE

LEGEND

PROPERTY LINE
1/4 SECTION LINE
EXISTING TRACK CENTERLINE
PROPOSED TRACK CENTERLINE
EXISTING CULVERT
PROPOSED RAIL LUBRICATOR
PROPOSED SWITCH
EXISTING RAIL EMBANKMENT CONTOURS
EXISTING CONTOUR
POTABLE WATER MAIN
SAN SEWER (GRAVITY)
EXISTING UNDERGROUND ELECTRICAL
EAST — E
WEST — W
NORTH — N
SOUTH — S

INDEX

A.01	TITLE PAGE
B.01	SITE MAP & ACCESS PLAN
B.02	OVERALL TRACK PLAN
C.01	NOTES & ESTIMATED QUANTITIES
D.01–D.07	SCHEDULE A – SPUR TRACK PLAN & PROFILE
D.08–D.11	SCHEDULE A – LOOP TRACK #1 (OUTER LOOP) PLAN & PROFILE
D.12–D.13	SCHEDULE A – LOOP TRACK #3 (GRAIN UNLOADING TRACK) PLAN & PROFILE
D.13	SCHEDULE A – LOOP TRACK #4 (LOOP EXIT TRACK) PLAN & PROFILE
D.14–D.17	SCHEDULE B – LOOP TRACK #2 (INNER STORAGE LOOP) PLAN & PROFILE
D.18–D.20	AT-GRADE CROSSING PLAN & PROFILE

LICENSED PROFESSIONAL ENGINEER
TERRENCE L. SMITH
13847
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

TERRENCE L. SMITH 6/26/07

My license renewal date is December 31, 2008.

Pages or sheets covered by this seal:
ALL SHEETS

ASSOCIATES INC.
ENGINEERING ARCHITECTURE SURVEYING
council bluffs omaha

PLC drawn
SMS designed
TLS approved
JUNE '07 date

project: RAIL SPUR AND STORAGE LOOP
RAIL CONSTRUCTION CONTRACT
client: SOUTHWEST IOWA RENEWABLE ENERGY, LLC
sheet: COVER SHEET

project no. 11315
sheet A.01

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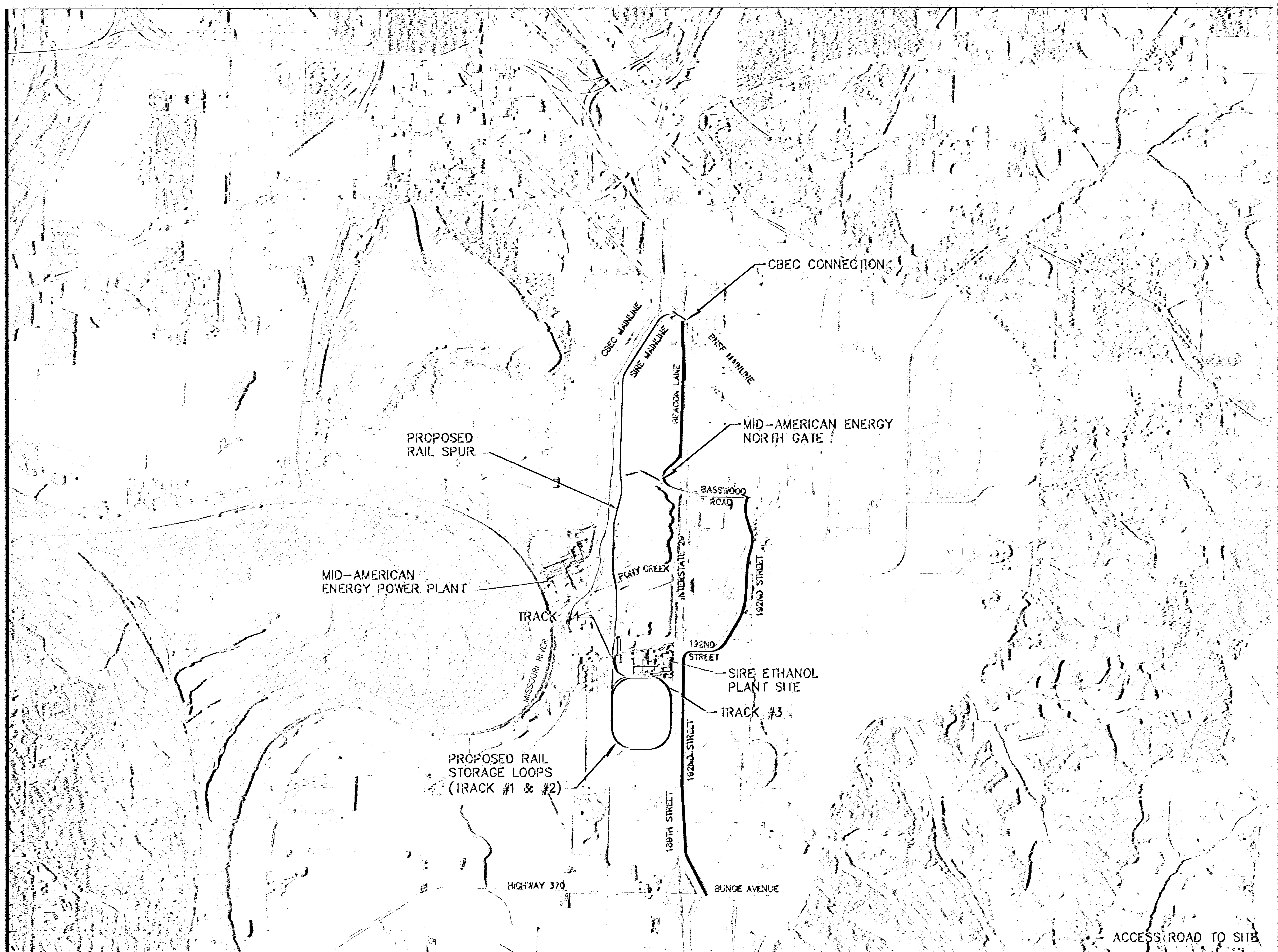
G:\Projects\11315-Ethanol Plant\dwg\sheets\Rail Contract\B01.dwg 5/9/2007 3:07:08 PM CDT



SITE MAP AND ACCESS PLAN

NO SCALE

hgm ASSOCIATES INC.
ENGINEERING ARCHITECTURE SURVEYING
council bluffs omaha

PLC drawn
SMB designed
TLS approved
JUNE '07 date

revision date

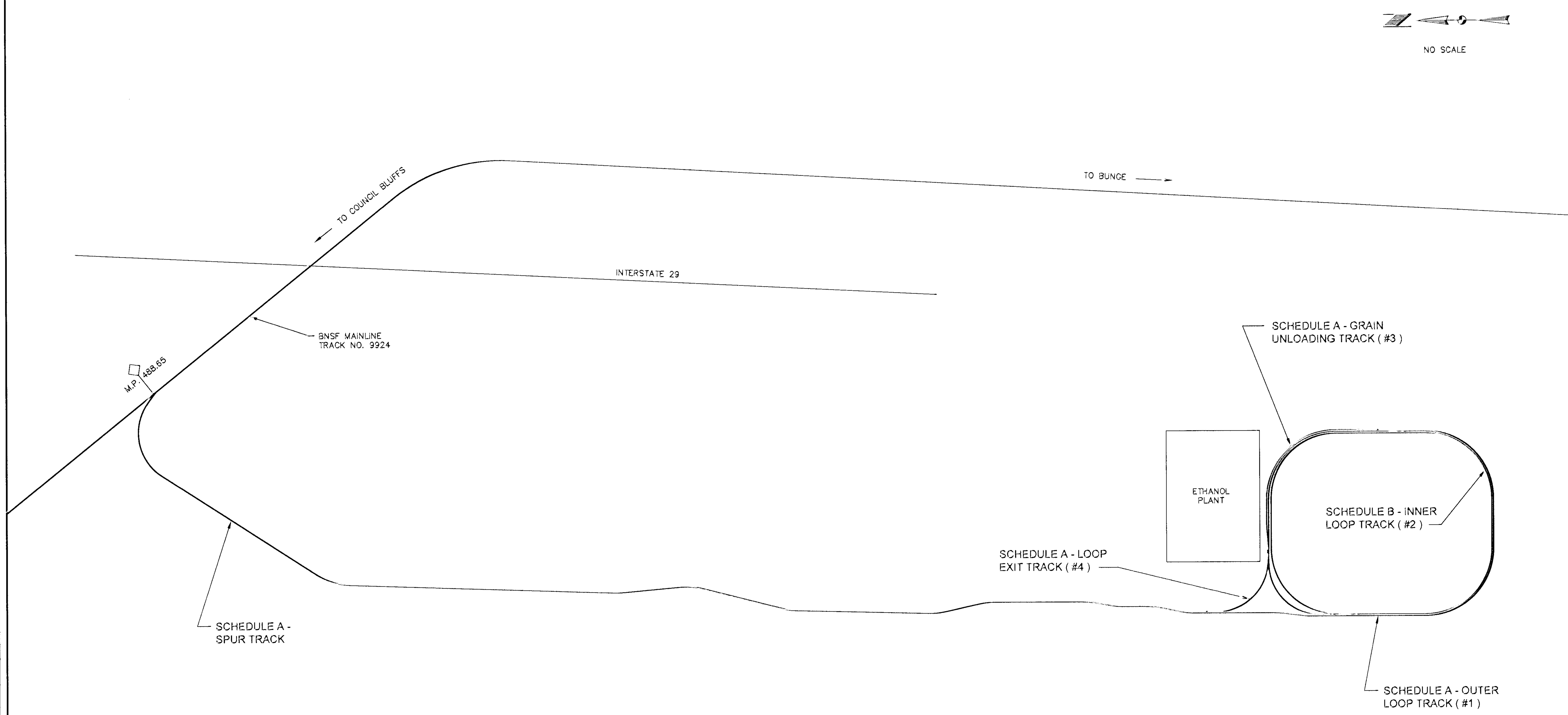
project RAIL SPUR AND STORAGE LOOP
RAIL CONSTRUCTION CONTRACT

client SOUTHWEST IOWA RENEWABLE ENERGY, LLC

sheet SITE MAP & ACCESS PLAN

project no. 11315

sheet B.01



hgm
ASSOCIATES INC.
ENGINEERING ARCHITECTURE SURVEYING
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drawn	JLB
designed	CMB
approved	TLS
date	JUNE '07
revision	
date	

project: RAIL SPUR AND STORAGE LOOP
RAIL CONSTRUCTION CONTRACT
client: SOUTHWEST IOWA RENEWABLE ENERGY, LLC
sheet: OVERALL TRACK PLAN

project no. 11315
sheet B.02

GENERAL NOTES

1. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION (AREMA) MANUAL FOR RAILWAY ENGINEERING, EXCEPT WHERE NOTED.
2. THE CONTRACTOR SHALL SUBMIT A PROPOSED SCHEDULE OF CONSTRUCTION TO THE ENGINEER A MINIMUM OF 10 DAYS PRIOR TO THE CONSTRUCTION START DATE.

GENERAL RAIL CONSTRUCTION NOTES

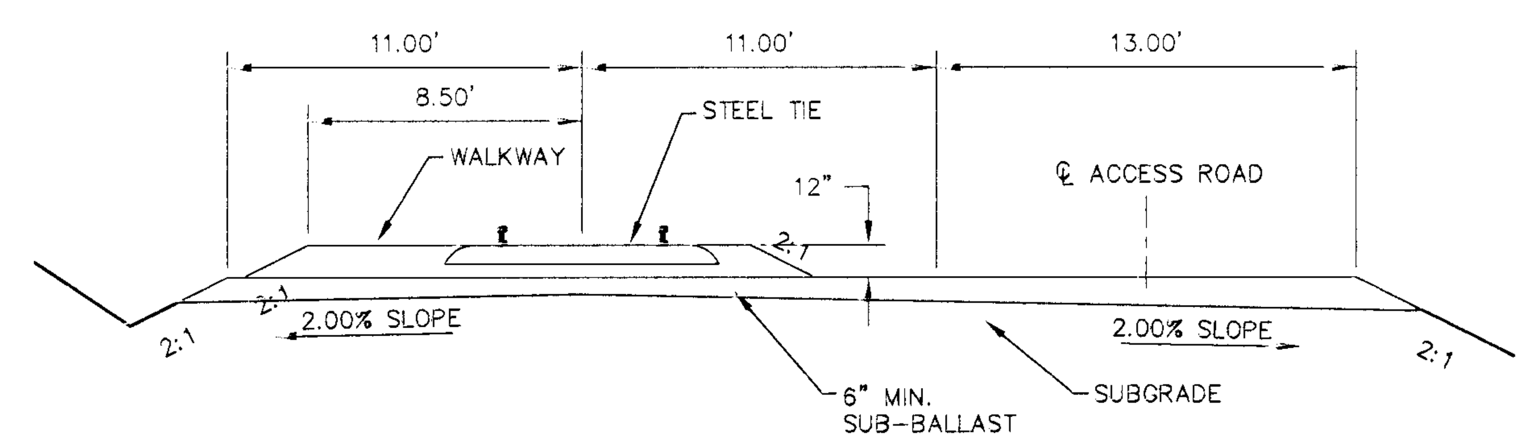
1. FURNISHING AND INSTALLATION OF THE BALLAST AND TRACK SHALL CONFORM TO THE BNSF RAILWAY DESIGN GUIDELINES FOR INDUSTRIAL TRACK PROJECTS.
2. INSTALLATION OF THE BALLAST SHALL INCLUDE WALKWAYS AT THE SWITCHES.
3. GRADING AND SUB-BALLAST WILL BE ACCOMPLISHED BY OTHERS PRIOR TO THE START OF THE TRACK WORK.
4. SUB-BALLAST DISTURBED BY THE CONTRACTOR SHALL BE REGRADED AND RECOMPACTED TO A UNIFORM SURFACE PRIOR TO PLACING BALLAST AND TRACK.
5. THE CONTRACTOR'S EQUIPMENT TRAFFIC SHALL BE CONFINED TO THE TOP OF THE TRACK BED.
6. RAIL SHALL BE NEW OR RELAY 115 LB. CC-CONTROLLED COOL (136 LB. CWR-CONTINUOUS WELDED RAIL IN SPECIFIED LOCATIONS). RELAY RAIL SHALL CONFORM TO THE AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION (AREMA) MANUAL FOR RAILWAY ENGINEERING, CURRENT ISSUE, CHAPTER 4, PART 2 – CLASS II OR BETTER, EXCEPT RAIL WEAR ON ANY SURFACE OF THE HEAD SHALL NOT EXCEED 3/16". RELAY RAIL SHALL BE FREE OF DEFECTS AND BOLT HOLES NOT NEEDED FOR ASSEMBLY. RAIL ANCHORS SHALL BE INSTALLED ON EACH TIE IN HORIZONTAL CURVES. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS AND MATERIAL CERTIFICATIONS FOR FURNISHED MATERIAL. THE OWNER RESERVES THE RIGHT TO REJECT ANY MATERIAL AND ASSEMBLIES IT DEEMS UNACCEPTABLE. THE UNIT PRICE SHALL INCLUDE JOINT BARS AND BOLTS FOR FASTENING RAIL SECTIONS TOGETHER (OR WELDING FOR CWR). RAIL WILL BE PAID BY LENGTH OF TRACK, NOT INCLUDING TURNOUTS.
7. TIES SHALL BE STEEL AS MANUFACTURED BY NORTH AMERICAN RAILWAY STEEL TIE CORPORATION (NARSTCO). CONTACT LARRY BELFIORE OF NARSTCO AT (402) 393-7825 FOR INFORMATION. THE UNIT PRICE SHALL INCLUDE SHOULDERS AND "e-CLIPS" FOR FASTENING RAIL TO TIES. CONTRACTOR SHALL ALSO PROVIDE ALTERNATE BID FOR USING NEW AREMA NO. 5 7" x 9" x 8'-6" INDUSTRIAL GRADE OR BETTER WOOD TIES AS DESCRIBED IN AREMA MANUAL FOR RAILWAY ENGINEERING CHAPTER 30, PART 3. USED TIES WILL NOT BE ACCEPTED. ALTERNATE BID SHALL ALSO INCLUDE NEW NO. 5 PANDROL-PLATED TIES IN THE THREE CURVES WHERE 136 LB. CONTINUOUS WELDED RAIL (CWR) IS SPECIFIED. SEE DETAILS ON THIS SHEET FOR TIE SPACING AND TYPICAL RAIL SECTIONS. THE UNIT PRICE SHALL INCLUDE TIE PLATES, ANCHORS, AND SPIKES. TIES SHALL BE PAID BY LENGTH OF TRACK INSTALLED, NOT INCLUDING TURNOUTS.
8. BALLAST SHALL CONFORM TO AREMA GRADATION NO. 5 AS DEFINED IN THE AREMA MANUAL FOR RAILWAY ENGINEERING CHAPTER 1, PART 2. THE CONTRACTOR SHALL SUBMIT PIT CERTIFICATIONS AND A REPRESENTATIVE 100 LB. SAMPLE TO THE OWNER PRIOR TO CONSTRUCTION. ADDITIONAL SAMPLES MAY BE REQUESTED IF THE SUPPLIED MATERIAL APPEARS TO DIFFER. SEE DETAILS ON THIS SHEET FOR BALLAST DEPTH. THE UNIT PRICE SHALL BE FOR DELIVERY, PLACEMENT, AND TAMPING.
9. TURNOUTS (SWITCHES) SHALL UTILIZE SAMSON POINT SWITCHES WITH ADJUSTABLE BRACING AND SHALL INCLUDE ALL SWITCH MECHANISMS, THROW RODS, SWITCH STANDS, FROGS, GUARD RAILS, ETC. REQUIRED FOR A COMPLETE INSTALLATION. SWITCH STANDS SHALL BE GROUND-THROW, LOW-TARGET WITH A MAXIMUM HEIGHT OF APPROXIMATELY 18". THE SWITCH STAND PROPOSED FOR USE SHALL BE APPROVED BY OWNER PRIOR TO INSTALLATION. FROGS SHALL BE RAIL-BOUND MANGANESE (RBM). THE UNIT PRICE SHALL INCLUDE ENTIRE TURNOUT ASSEMBLY.
10. RAIL THROUGH GRAIN LOADOUT BUILDING SHALL BE FASTENED TO THE EXISTING STEEL BASE PLATE WITH PANDROL WELD-ON SHOULDERS AND 'e' CLIPS. RAIL ACROSS DUMP PIT SHALL BE FASTENED TO EXISTING I-BEAMS WITH NO. 62 RAIL CLIPS. THE UNIT PRICES FOR BID ITEMS NO. 9, 10, AND 11 SHALL INCLUDE ALL MATERIALS, EQUIPMENT, DRILLING, WELDING, AND LABOR TO INSTALL THE CLIPS ACCORDING TO THE DETAILS ON THIS SHEET.
11. TIMBER AND CONCRETE AT-GRADE CROSSINGS SHALL BE CONSTRUCTED ACCORDING TO BNSF DESIGN STANDARDS. THE UNIT PRICE SHALL INCLUDE ALL MATERIALS, EQUIPMENT, AND LABOR FOR CONSTRUCTION OF THE CROSSING, INCLUDING RUBBER FLANGEWAY FILLERS. THE RAIL AND TIES SHALL NOT BE INCLUDED IN THE UNIT PRICE. CONTRACTOR SHALL PROVIDE ALTERNATE BID FOR AT-GRADE CROSSINGS IF WOOD TIES ARE USED.
12. WAYSIDE TRACK LUBRICATORS SHALL BE MANUFACTURED BY PORTEC RAIL PRODUCTS, INC., 900 OLD FREEPORT ROAD, PITTSBURGH, PA 15238, (412) 782-6000. SINGLE-TRACK LUBRICATORS SHALL BE PROTECTOR-IV 800 ST WITH FOUR (4) MC-4 BARS. DUAL-TRACK LUBRICATORS SHALL BE PROTECTOR-IV 800 DT WITH FOUR (4) MC-4XL BARS PER TRACK. WAYSIDE LUBRICATORS SHALL BE INSTALLED AT LOCATIONS SPECIFIED IN THE PLANS ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS. THE UNIT PRICE SHALL INCLUDE ENTIRE LUBRICATION SYSTEM AND INSTALLATION..
13. CROSSBUCK SIGNS SHALL BE INSTALLED AT ALL AT-GRADE RAIL CROSSINGS. ADVANCE WARNING SIGNS AND PAVEMENT MARKING SHALL BE INSTALLED ON THE MID-AMERICAN ENERGY ENTRANCE ROAD NORTH OF THE ETHANOL PLANT SITE. THESE DEVICES SHALL BE INSTALLED ACCORDING TO THE FEDERAL HIGHWAY ADMINISTRATION MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD). PAVEMENT MARKING SHALL BE PERMANENT. THE UNIT PRICE SHALL INCLUDE THE SIGNPOST AND INSTALLATION.
14. THE CONTRACTOR SHALL CARRY RAILROAD PROTECTIVE LIABILITY INSURANCE AS REQUIRED BY BNSF RAILWAY FOR CONTRACTORS WORKING ON BNSF RIGHT-OF-WAY. A SEPARATE POLICY IS REQUIRED FOR WORKING ON CBEC AND MID-AMERICAN ENERGY PROPERTY. INSURANCE REQUIREMENTS ARE OUTLINED IN THE CONTRACT DOCUMENTS AND SHALL BE INCLUDED WITH THE PROPOSAL.

CBEC AND MID-AMERICAN ENERGY RAIL CONSTRUCTION NOTES

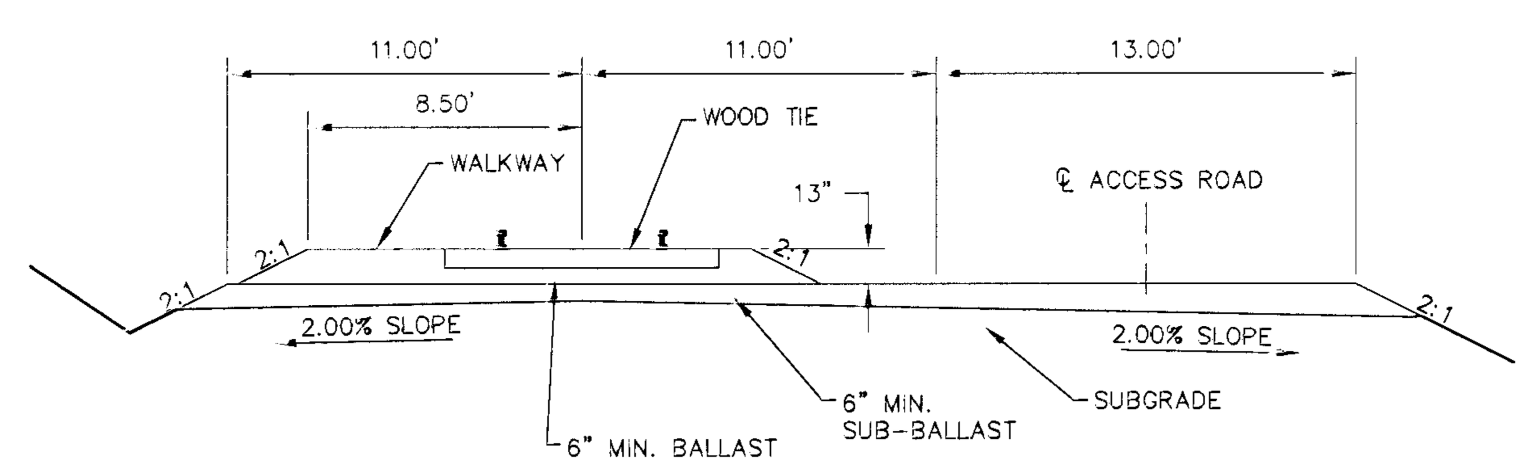
1. CONTRACTOR SHALL CONFINE WORK, EQUIPMENT TRAFFIC AND MATERIAL STORAGE TO WITHIN THE BOUNDARIES OF THE TEMPORARY CONSTRUCTION EASEMENTS.
2. CONTRACTOR SHALL ATTEND ALL SAFETY ORIENTATIONS REQUIRED BY BNSF RAILWAY, CBEC RAILWAY OR MID-AMERICAN ENERGY PRIOR TO BEGINNING WORK ON RESPECTIVE PROPERTIES.
3. CONTRACTOR SHALL NOTIFY ENGINEER THREE (3) WEEKS IN ADVANCE OF ALL WORK THAT WILL TAKE PLACE ON BNSF RIGHT-OF-WAY (WITHIN 25 FEET OF CENTERLINE OF BNSF TRACK) SO THAT FLAGGING SERVICES CAN BE ARRANGED AND SCHEDULED WITH BNSF RAILWAY. FLAGGING SERVICES WILL BE PAID BY THE OWNER.
4. CONTRACTOR SHALL NOTIFY ENGINEER 48 HOURS PRIOR TO COMMENCING WORK ON MID-AMERICAN ENERGY PROPERTY.
5. CBEC RAILWAY IS RESPONSIBLE FOR DELIVERING COAL TO THE MID-AMERICAN ENERGY POWER PLANT. CONTRACTOR SHALL NOT INTERRUPT COAL DELIVERY OPERATIONS AT ANY TIME.
6. CONTRACTORS SHALL NOT INTERRUPT MID-AMERICAN ENERGY POWER PLANT OPERATIONS AT ANY TIME.

SPUR AND LOOP TRACK LENGTH INFORMATION

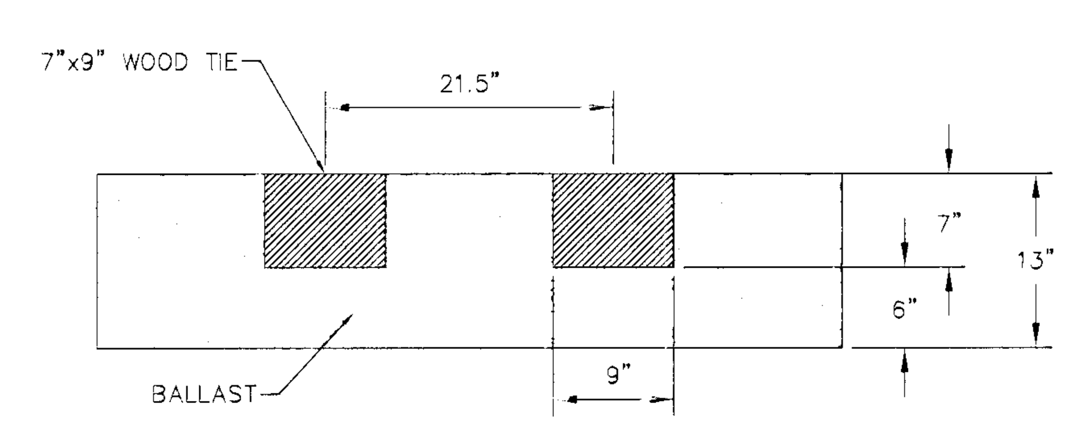
SPUR TRACK:	15,202 LF
MAIN LOOP TRACK:	8,295 LF
INNER LOOP TRACK:	8,086 LF
LOOP EXIT TRACK:	3,399 LF
TOTAL LENGTH OF TRACK:	34,982 LF



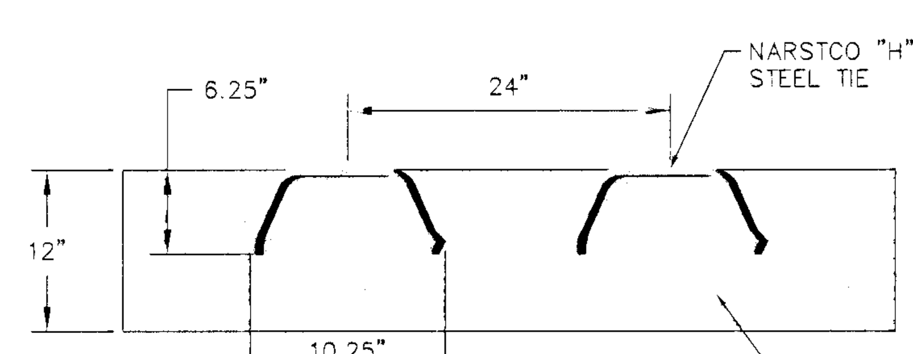
TYPICAL RAIL SECTION WITH STEEL TIES
SCALE: 1" = 5'-0"



TYPICAL RAIL SECTION WITH WOOD TIES
SCALE: 1" = 5'-0"



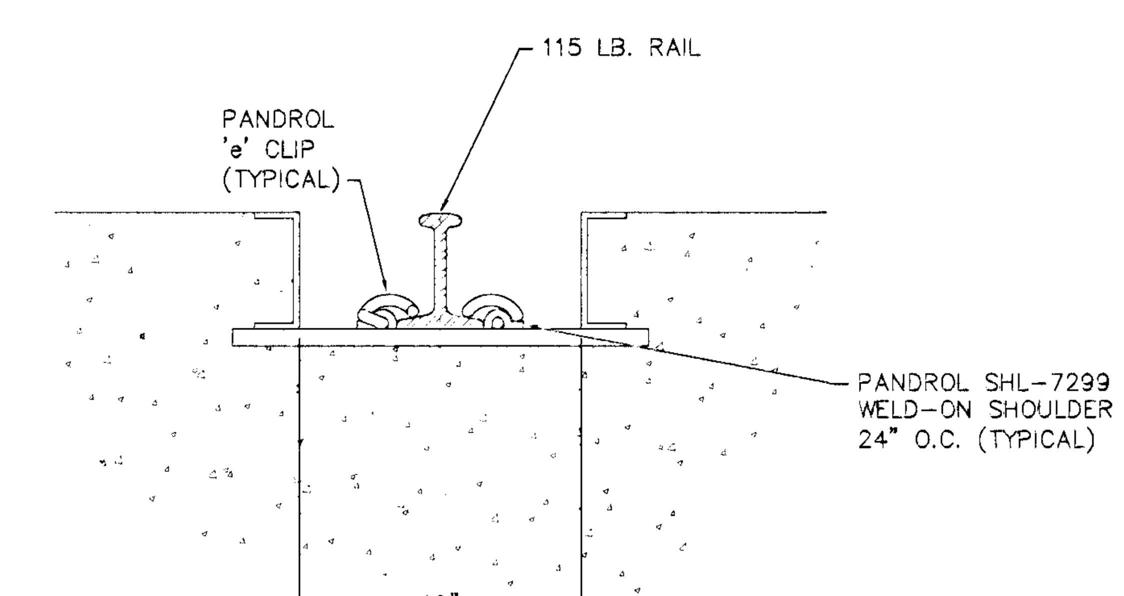
WOOD TIE SPACING
SCALE: 1" = 1'-0"



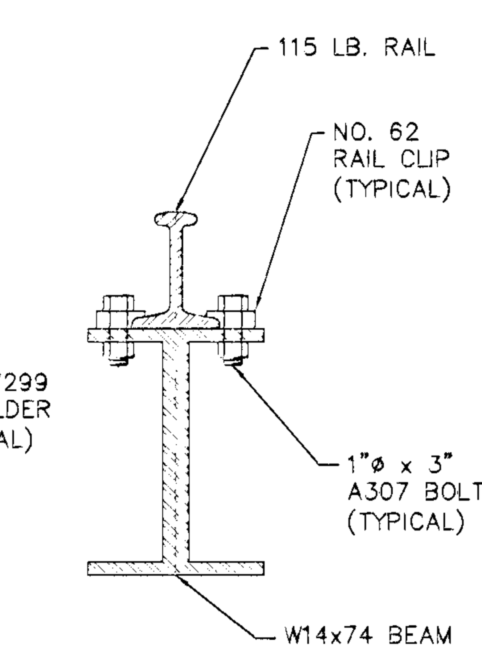
STEEL TIE SPACING
SCALE: 1" = 1'-0"

ESTIMATED QUANTITIES

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITIES	UNITS
SCHEDULE A - SPUR TRACK AND LOOP TRACKS #1, #3, AND #4			
1	MOBILIZATION	1	LS
2	115 LB. CC (CONTROLLED COOL) RAIL	23,962	TRK-FT
3	136 LB. CWR (CONTINOUS WELDED RAIL)	2,934	TRK-FT
4	NARSTCO H10 STEEL TIES	12,585	TRK-FT
5	NARSTCO M10 STEEL TIES	14,061	TRK-FT
6	BALLAST FOR STEEL TIES (12" DEPTH)	26,646	TRK-FT
7	BNSF NO. 11 TURNOUT	10	EA
8	DOUBLE SWITCH POINT DERAIL	2	EA
9	PANDROL SHL-7299 FORGED STEEL WELD-ON SHOULDERS	210	EA
10	PANDROL 'e' CLIPS	210	EA
11	NO. 62 RAIL CLIPS	40	EA
12	TIMBER PLANK CROSSING-ATTACH TO STEEL TIES (4 EA)	112	LF
13	CONCRETE PANEL CROSSING-ATTACH TO STEEL TIES (2 EA)	48	LF
14	REMOVE ASPHALT PAVEMENT FOR AT-GRADE RAIL CROSSING	103	SY
15	SINGLE-TRACK WAYSIDE LUBRICATOR, COMPLETE	1	EA
16	DUAL-TRACK WAYSIDE LUBRICATOR, COMPLETE	2	EA
17	CROSSBUCK SIGNS	10	EA
18	ADVANCE WARNING SIGNS	2	EA
19	PERMANENT PAVEMENT MARKING	1	LS
20	INSURANCE	1	LS
SCHEDULE B - INNER LOOP TRACK (LOOP TRACK #2)			
1	115 LB. CC (CONTROLLED COOL) RAIL	8,086	TRK-FT
2	NARSTCO H10 TIES	8,086	TRK-FT
3	BALLAST FOR STEEL TIES (12" DEPTH)	8,086	TRK-FT
4	TIMBER PLANK CROSSING-ATTACH TO STEEL TIES (1 EA)	16	LF
ALTERNATE BIDS - WOOD TIES			
A1	AREMA NO. 5 WOOD TIES	31,798	TRK-FT
A2	AREMA NO. 5 PANDROL-PLATED WOOD TIES	2,934	TRK-FT
A3	BALLAST FOR WOOD TIES (13" DEPTH)	34,732	TRK-FT
A4	TIMBER PLANK CROSSING-ATTACH TO WOOD TIES (5 EA)	128	LF
A5	CONCRETE PANEL CROSSING-ATTACH TO WOOD TIES (2 EA)	48	LF



RAIL FASTENING DETAIL FOR STEEL BASE PLATE
NO SCALE



RAIL FASTENING DETAIL FOR DUMP PIT I-BEAMS
NO SCALE

LOADOUT BUILDING RAIL FASTENING DETAILS

hgm ASSOCIATES INC.
ENGINEERING ARCHITECTURE SURVEYING
council bluffs omaha

PLC drawn
SMB designed
TLS approved
JUNE '07 date
revision
date

project: RAIL SPUR AND STORAGE LOOP
RAIL CONSTRUCTION CONTRACT
client: SOUTHWEST IOWA RENEWABLE ENERGY, LLC
sheet: NOTES & ESTIMATED QUANTITIES

project no. 11315
sheet C.01

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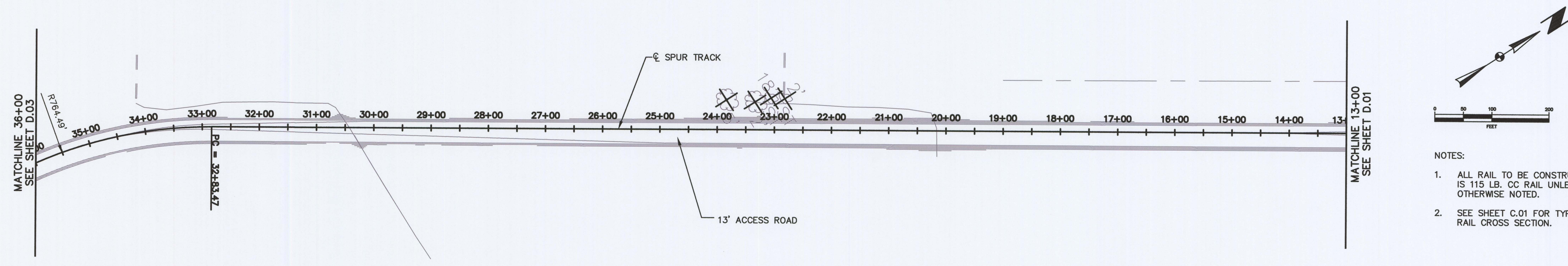
S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.01

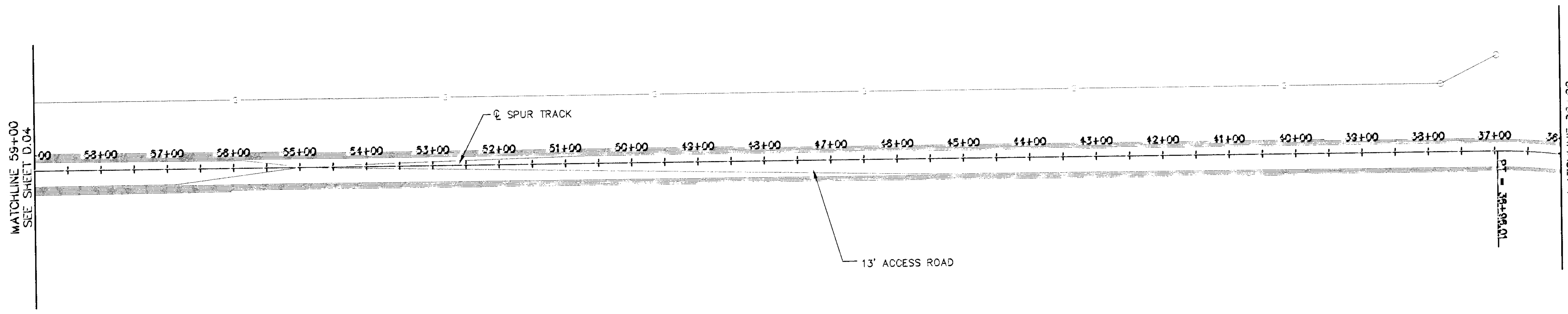


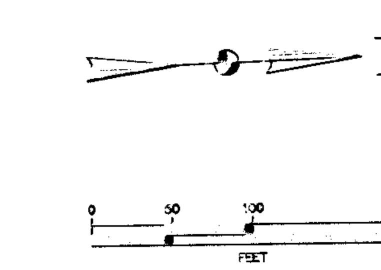
NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE A
SPUR TRACK

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.02



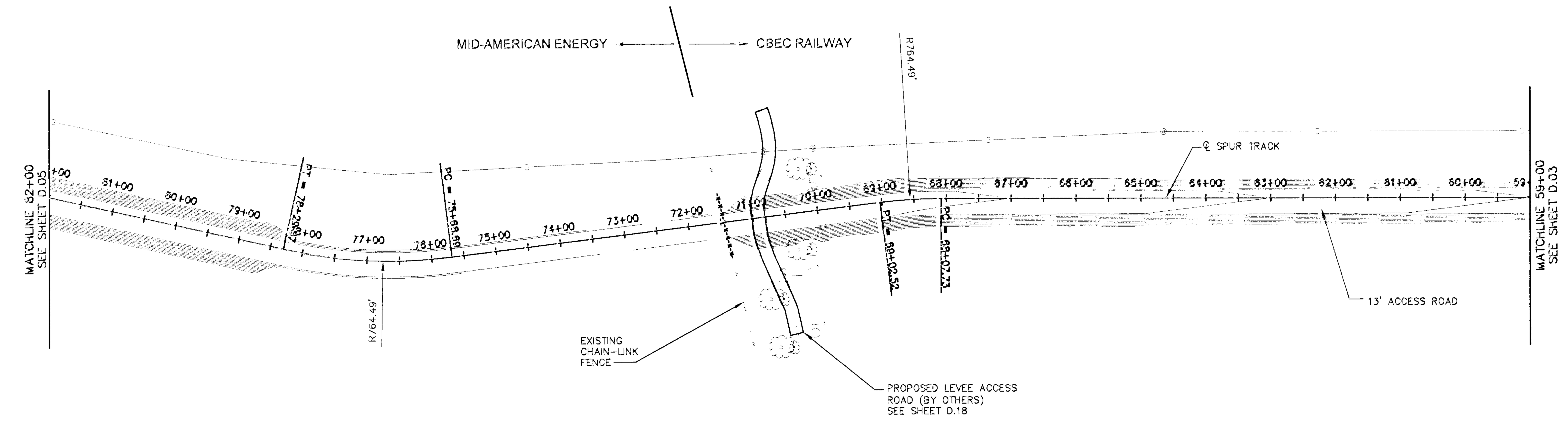


NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE A SPUR TRACK

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.03

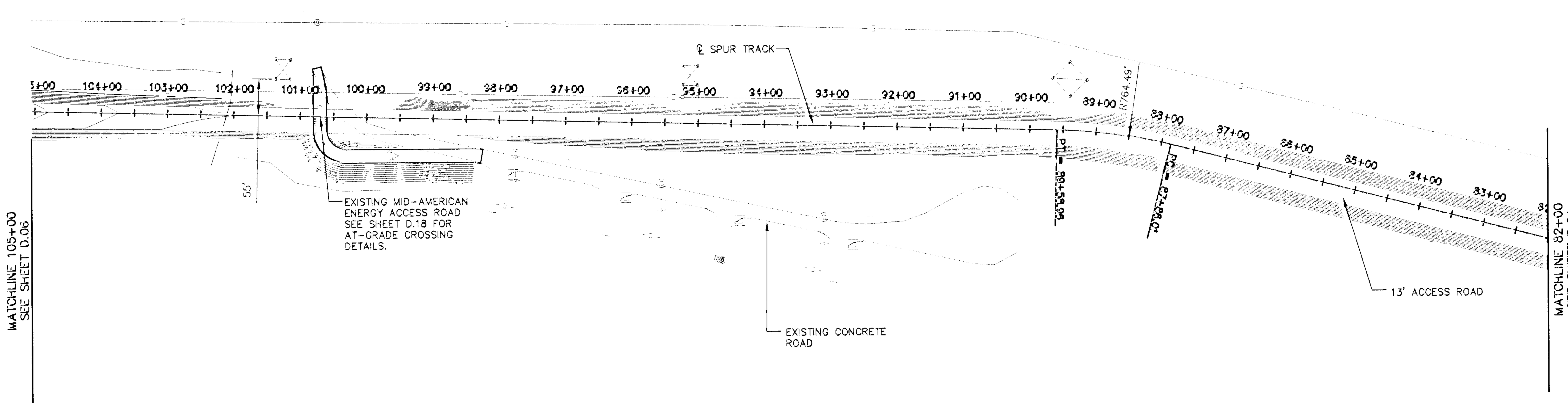


NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE A SPUR TRACK

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.04

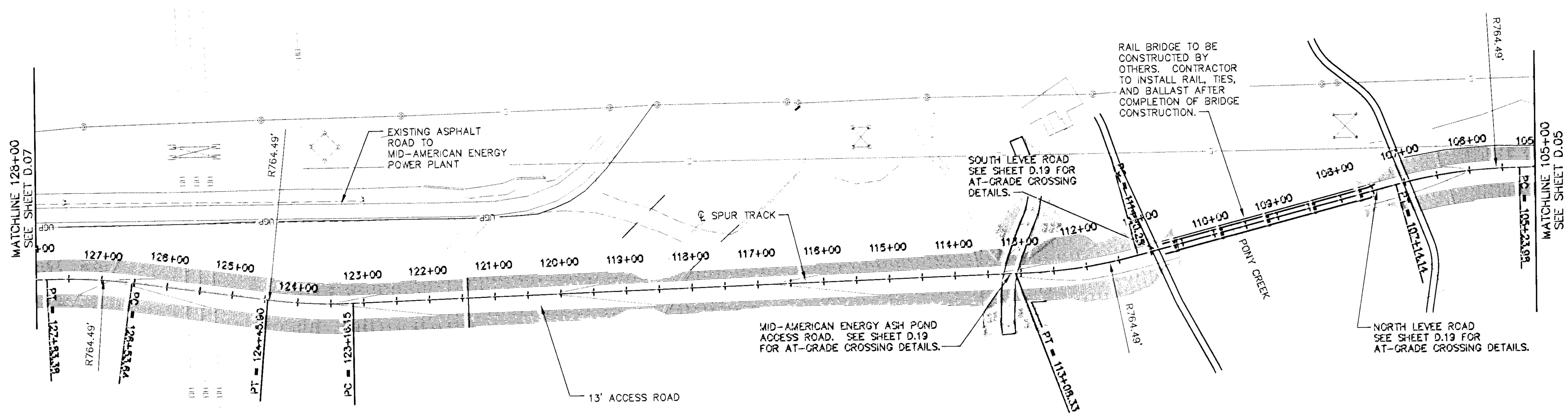


NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE A SPUR TRACK

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.05

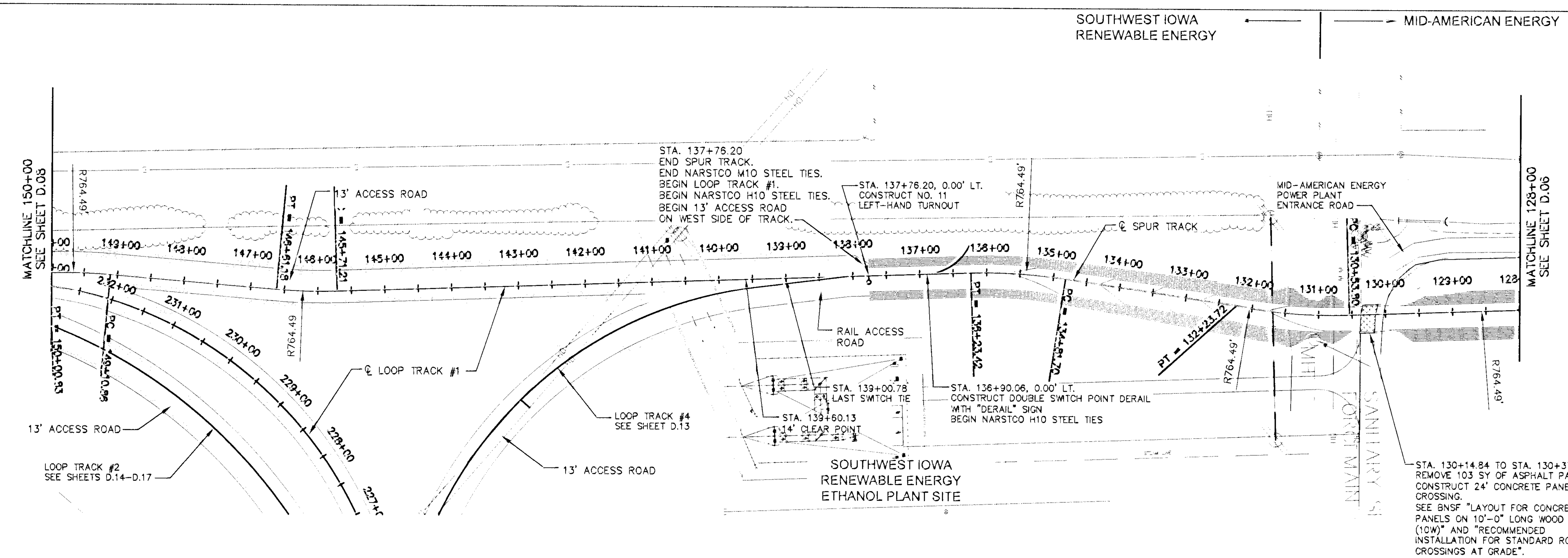


NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE A SPUR TRACK

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.06

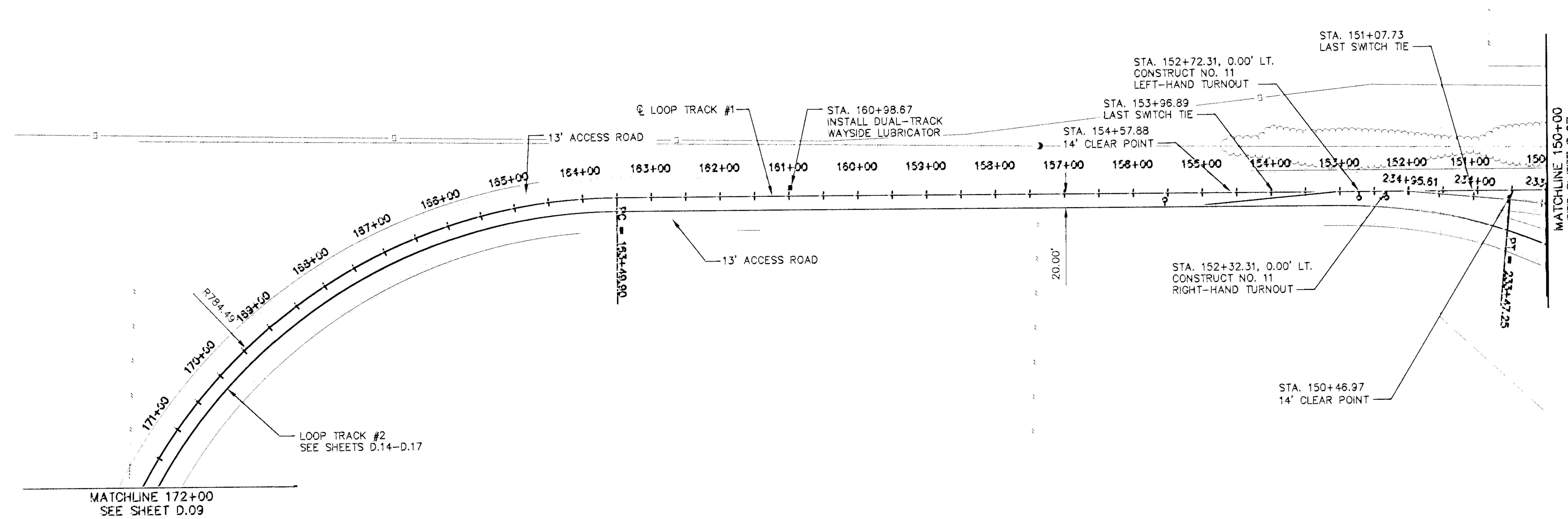


NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. ALL LOOP TRACK SHALL USE NARSTCO H10 STEEL TIES.
3. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.
4. MID-AMERICAN ENERGY OPERATIONS IN THIS AREA SHALL NOT BE INTERRUPTED BY RAIL CONSTRUCTION AT ANY TIME.
5. PERMANENT PAVEMENT MARKING FOR AT-GRADE CROSSING ON MID-AMERICAN ENERGY ENTRANCE ROAD SHALL BE ACCORDING TO IDOT ROAD DESIGN DETAIL 9105-"STANDARD PAVEMENT RAILROAD AND HIGHWAY GRADE CROSSING WITHOUT GATES".

SCHEDULE A
SPUR TRACK AND LOOP TRACK #1

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.07

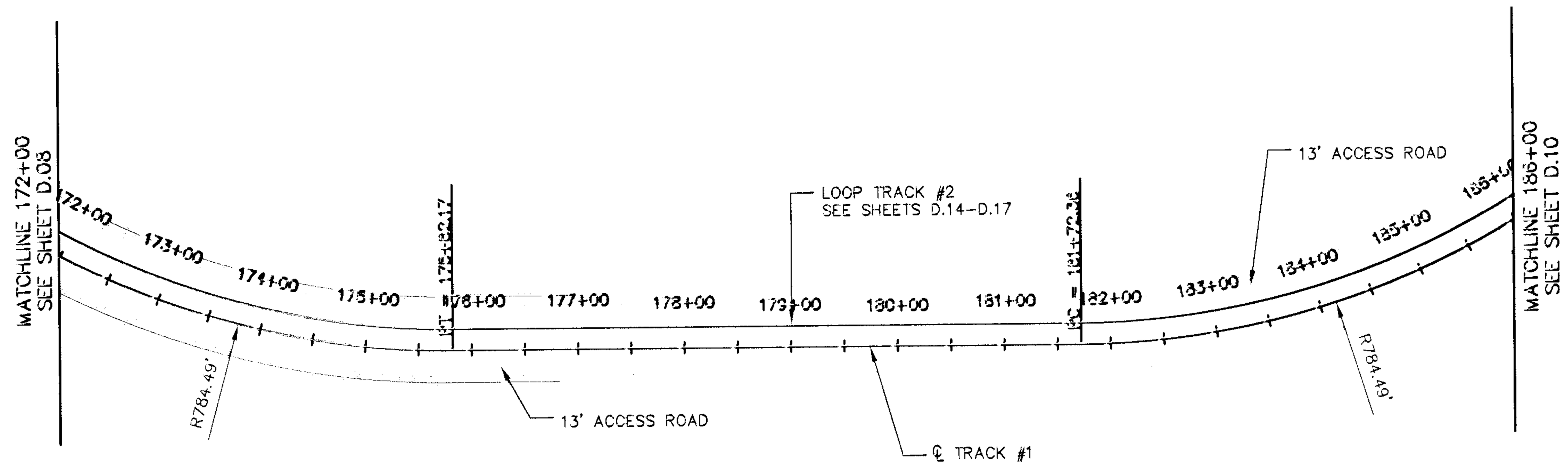


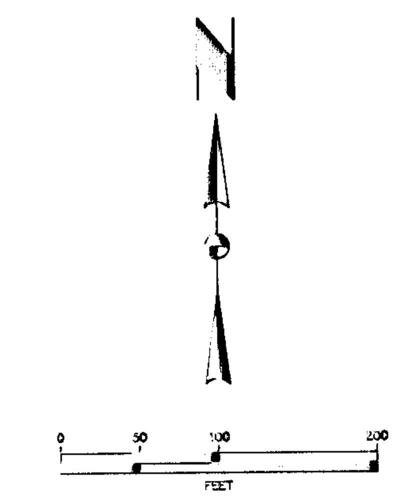
NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. ALL LOOP TRACK SHALL USE NARSTCO H10 STEEL TIES.
3. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE A
LOOP TRACK #1

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.08



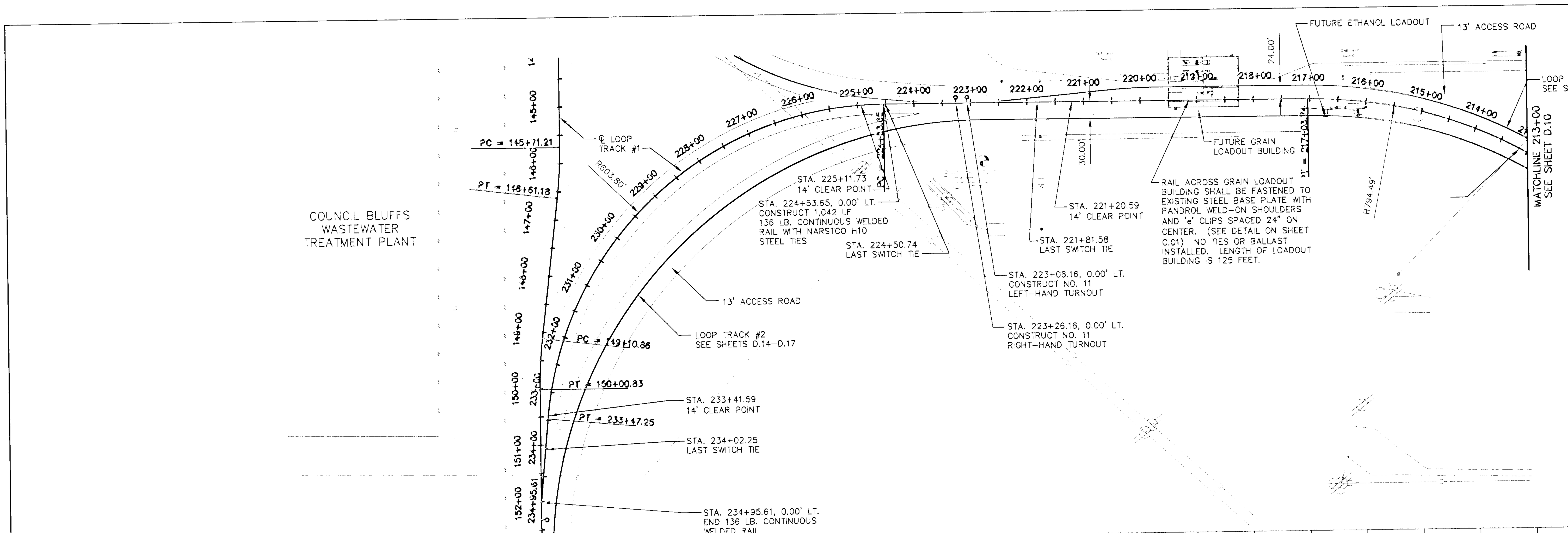


NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. ALL LOOP TRACK SHALL USE NARSTCO H10 STEEL TIES.
3. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE A
LOOP TRACK #1

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.10

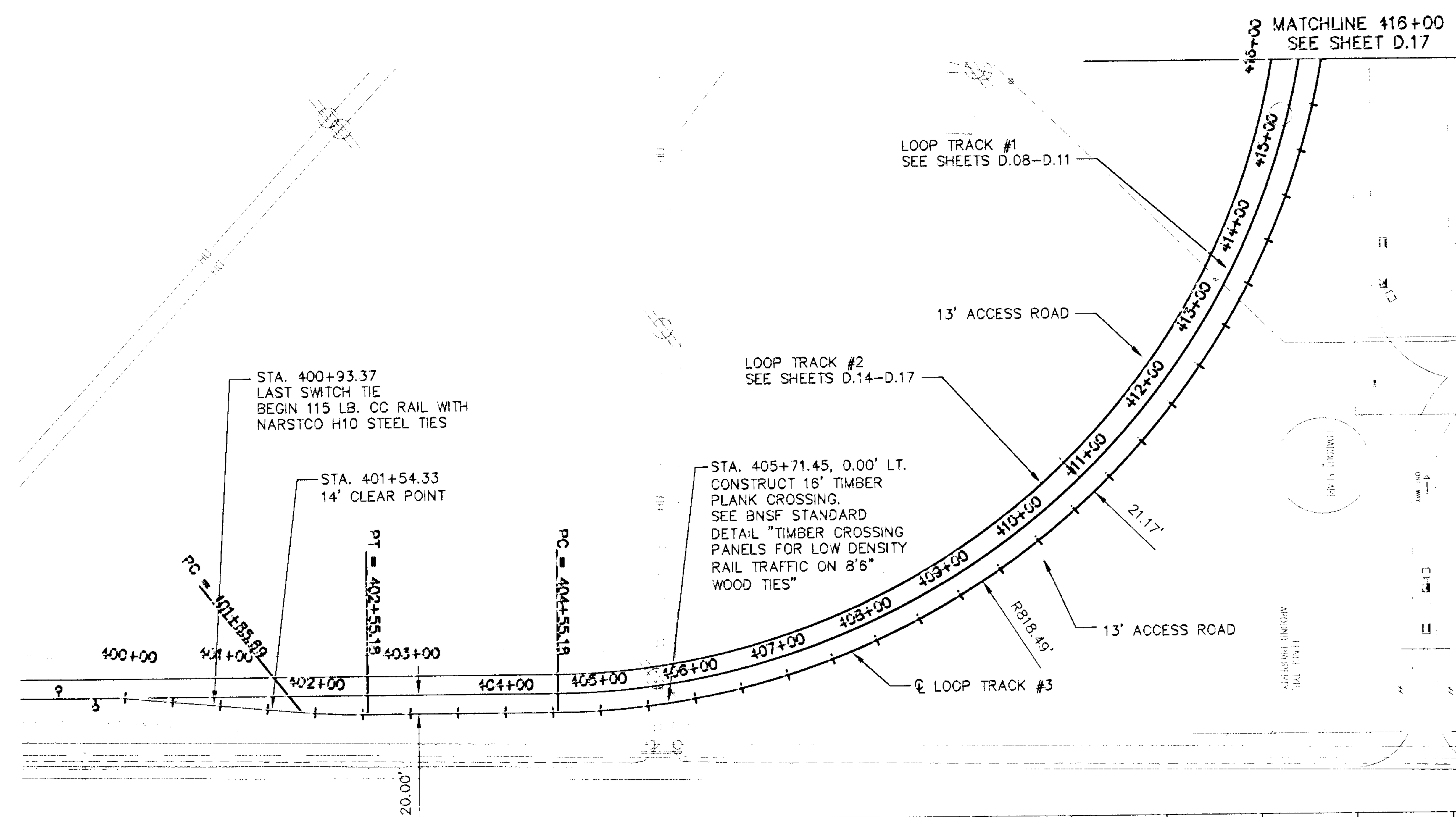


NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. ALL LOOP TRACK SHALL USE NARSTCO H10 STEEL TIES.
3. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.
4. CONTRACTOR SHALL COORDINATE RAIL CONSTRUCTION WITH WORK IN THE GRAIN AND ETHANOL LOADOUT AREAS.

SCHEDULE A
LOOP TRACK #1

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.11

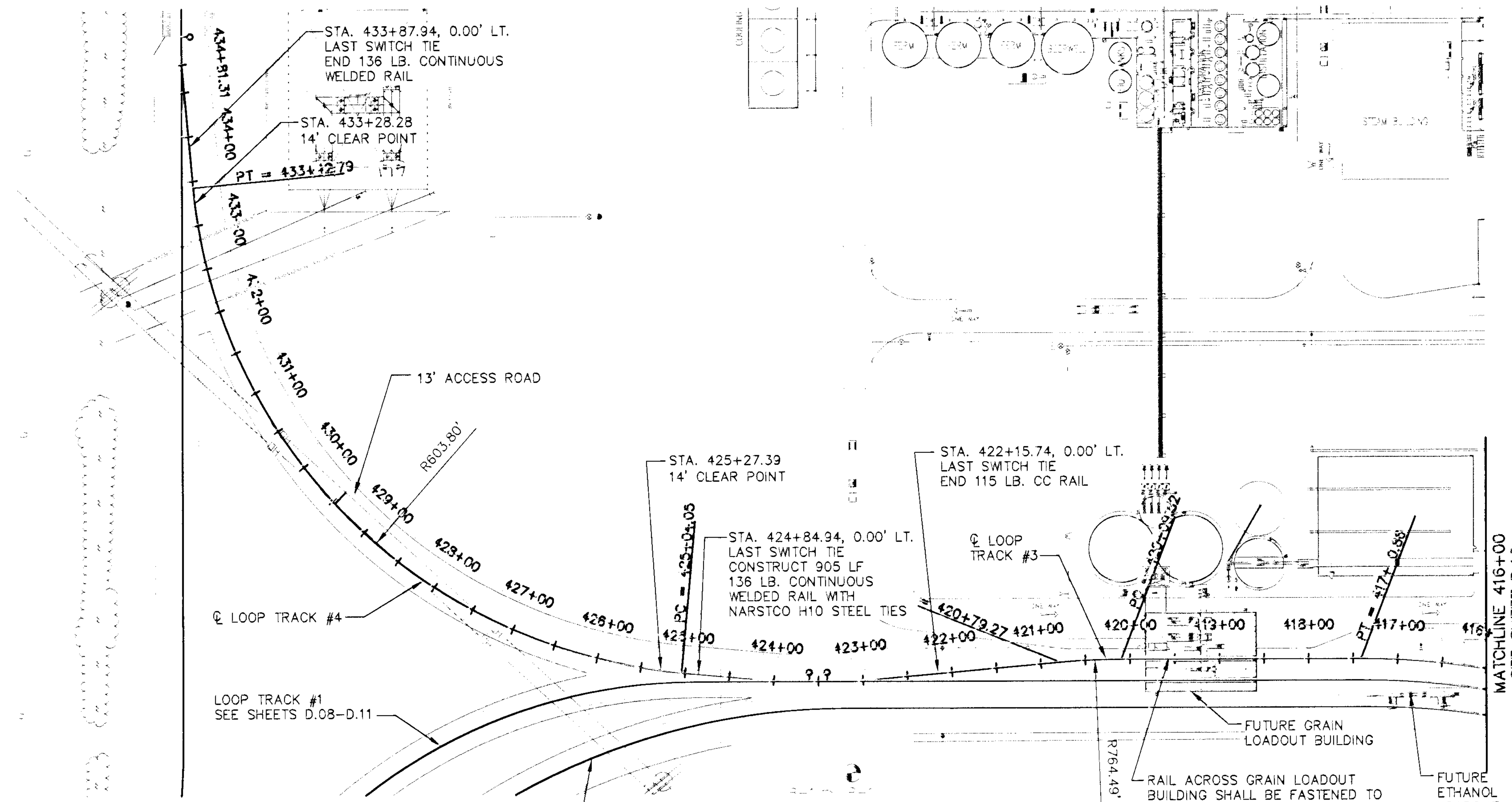


NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. ALL LOOP TRACK SHALL USE NARSTCO H10 STEEL TIES.
3. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE A
LOOP TRACK #3

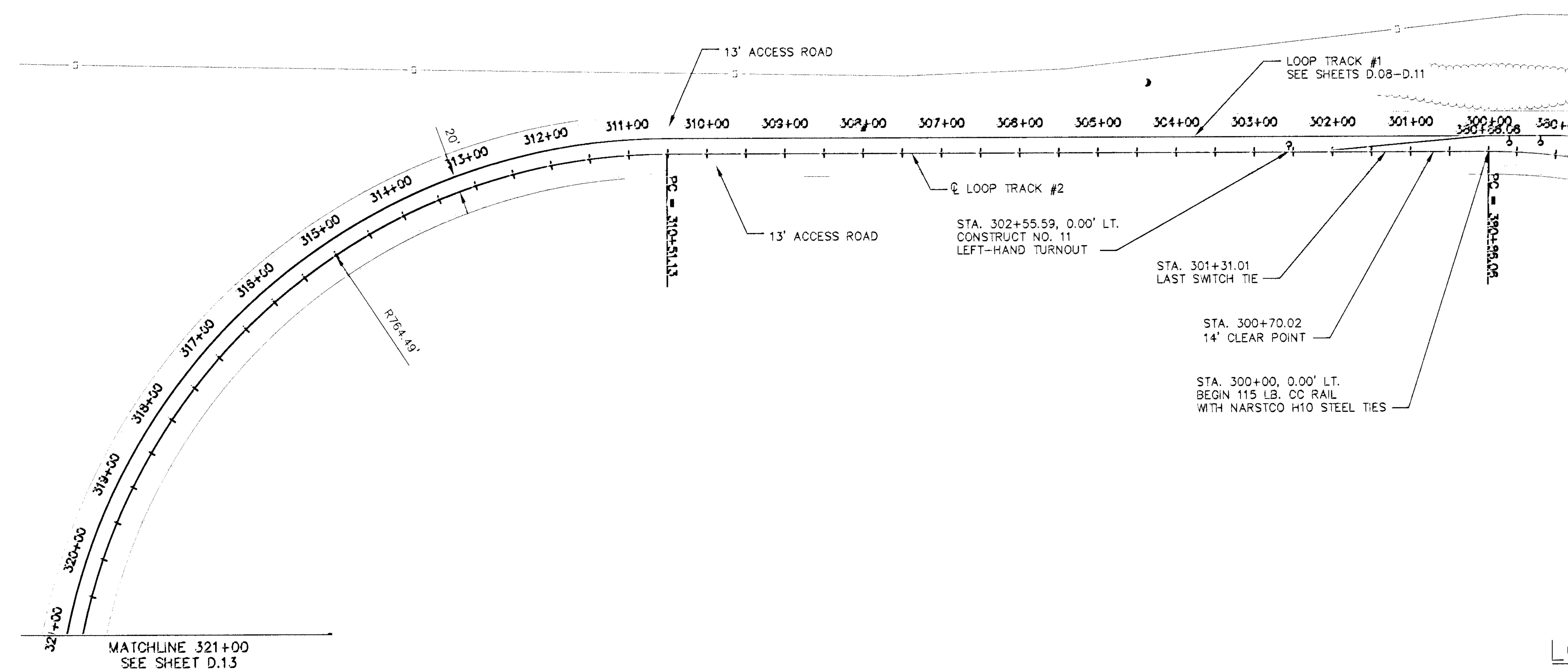
S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.12



NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. ALL LOOP TRACK SHALL USE NARSTCO H10 STEEL TIES.
3. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.
4. CONTRACTOR SHALL COORDINATE RAIL CONSTRUCTION WITH WORK IN THE GRAIN AND ETHANOL LOADOUT AREAS.

SCHEDULE A
LOOP TRACK #3 & #4

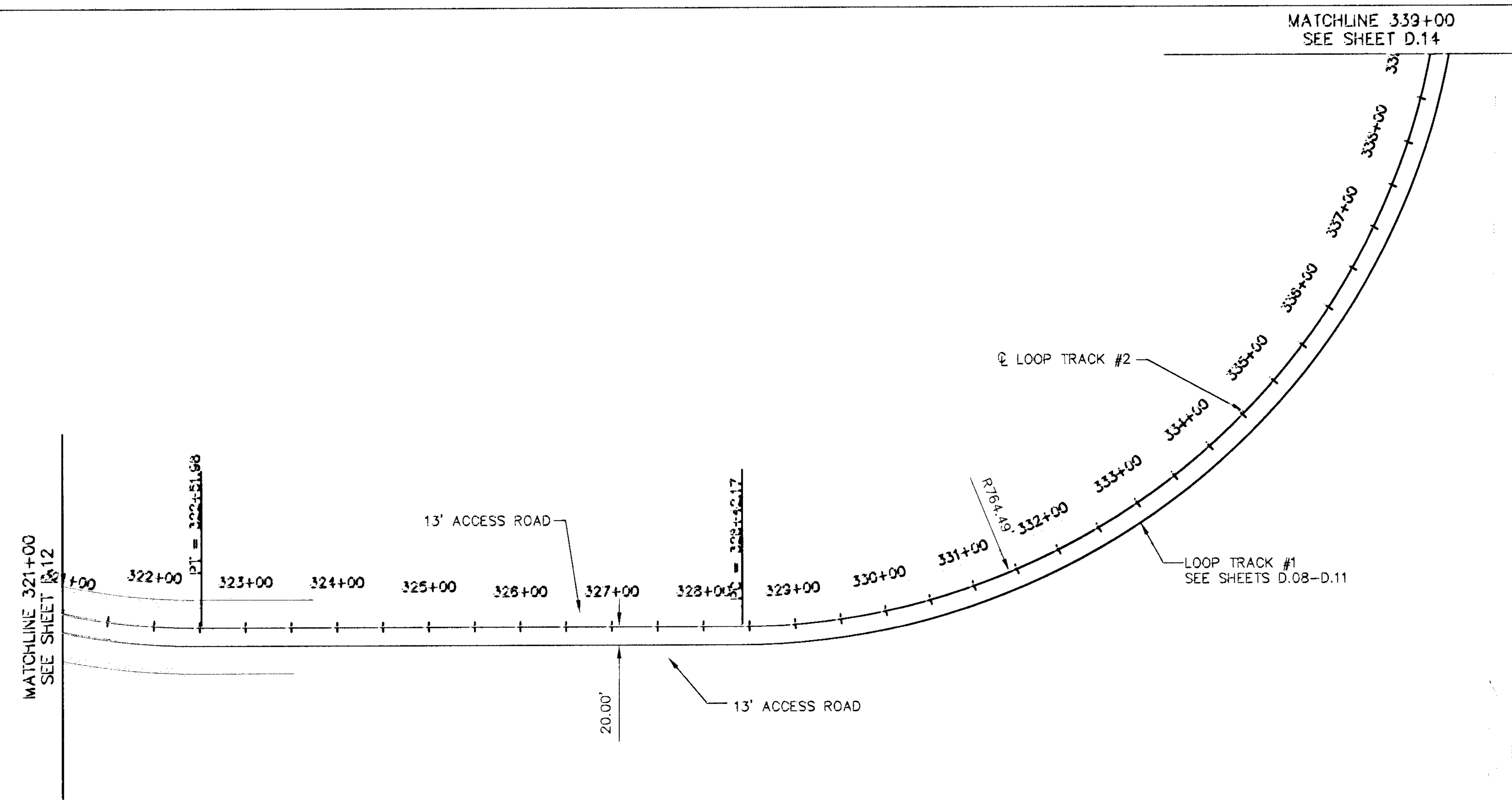


NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. ALL LOOP TRACK SHALL USE NARSTCO H10 STEEL TIES.
3. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE B
LOOP TRACK #2

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.14

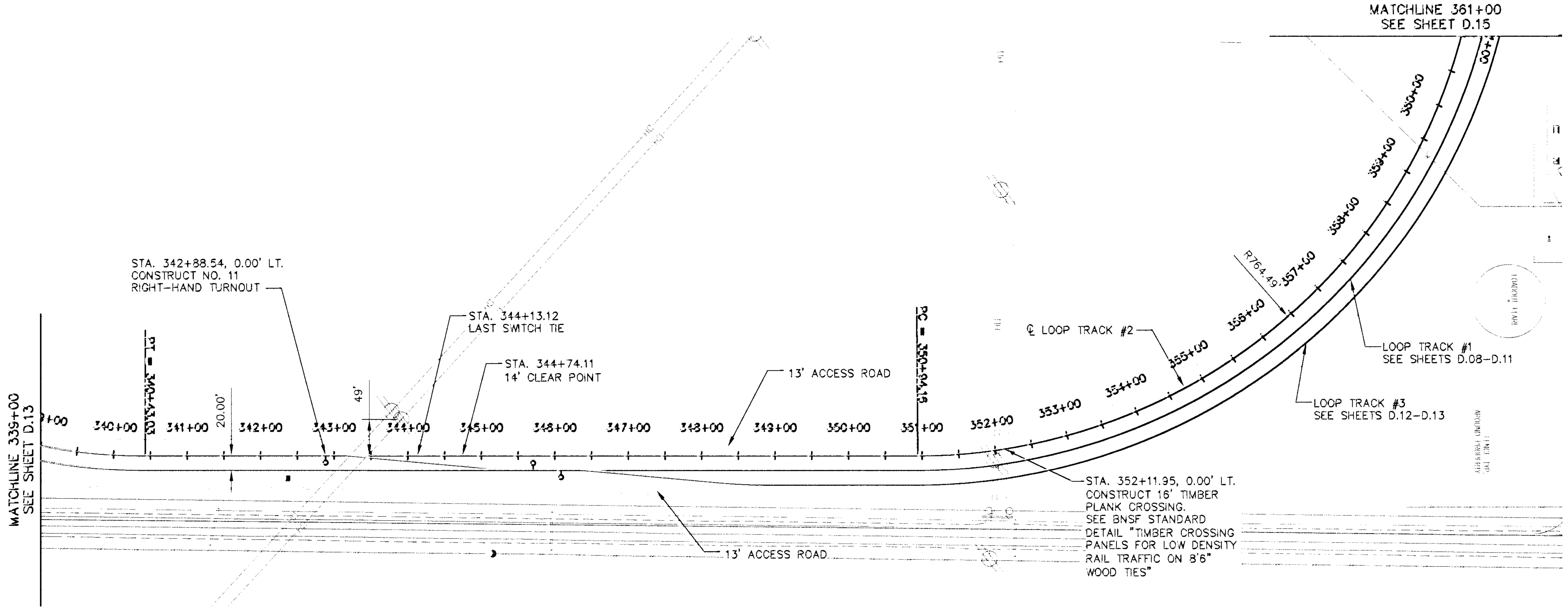


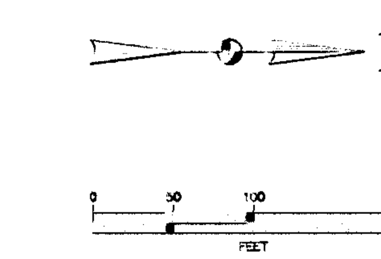
NOTES:

1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. ALL LOOP TRACK SHALL USE NARSTCO H10 STEEL TIES.
3. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE B
LOOP TRACK #2

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.15



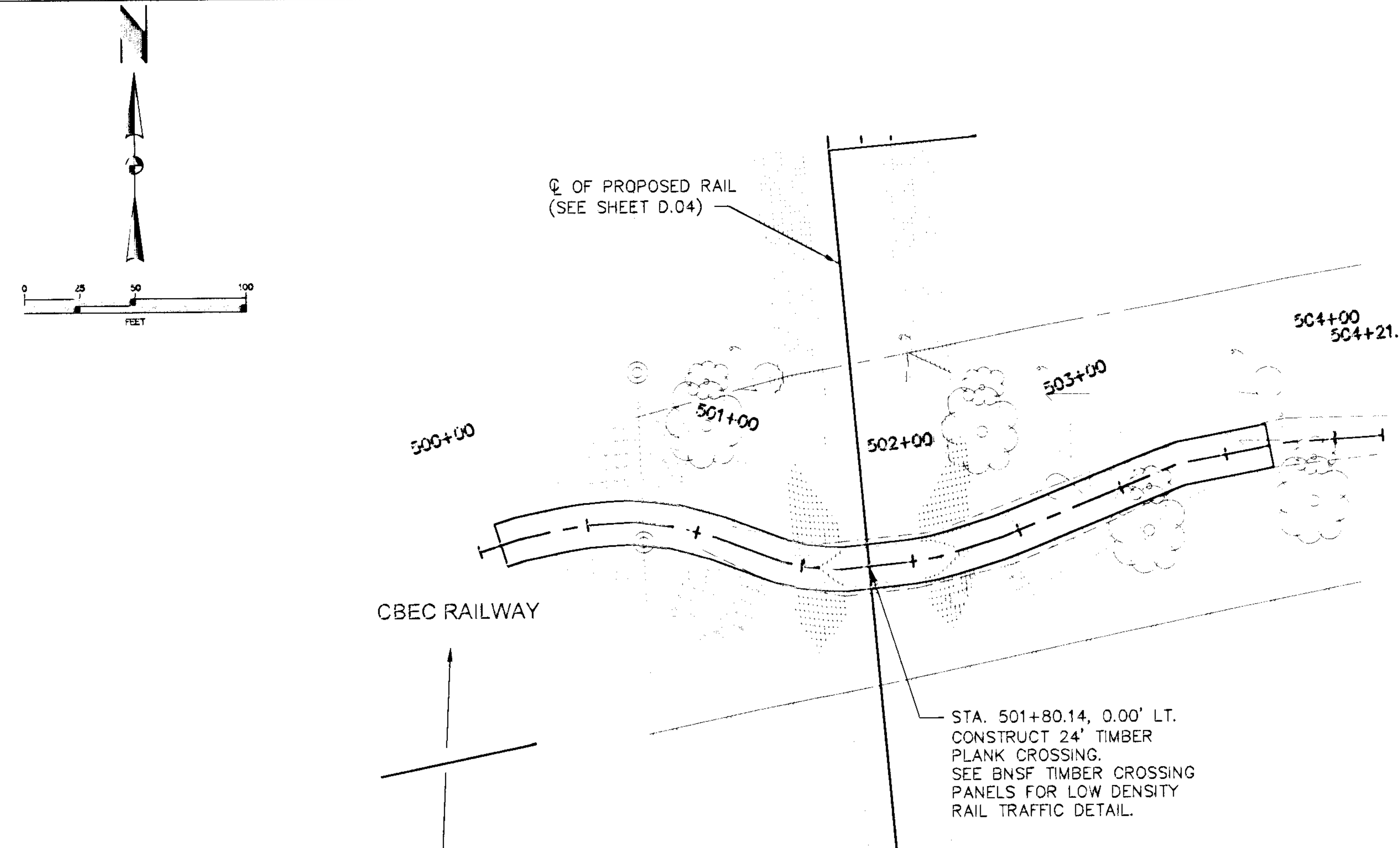


NOTES:

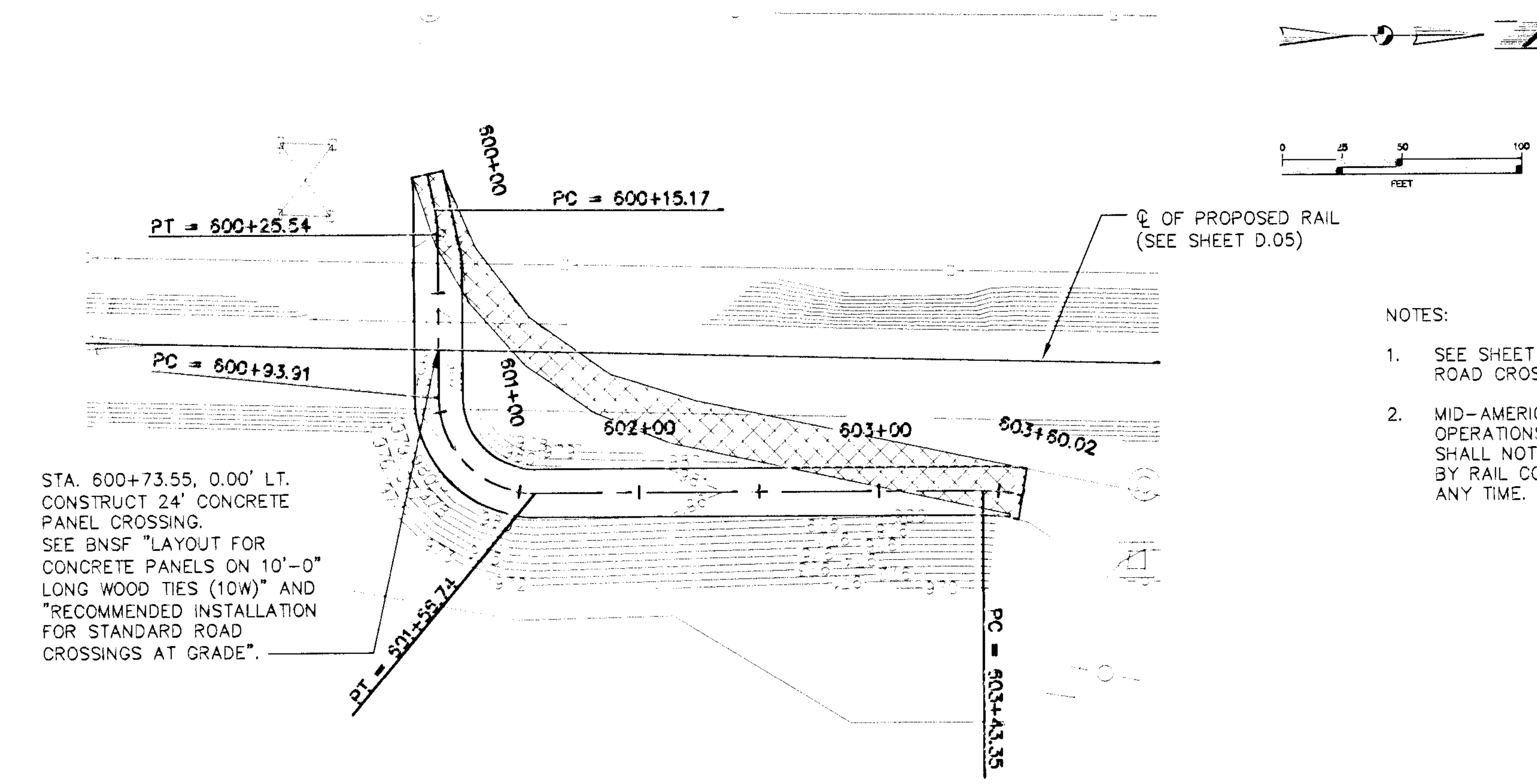
1. ALL RAIL TO BE CONSTRUCTED IS 115 LB. CC RAIL UNLESS OTHERWISE NOTED.
2. ALL LOOP TRACK SHALL USE NARSTCO H10 STEEL TIES.
3. SEE SHEET C.01 FOR TYPICAL RAIL CROSS SECTION.

SCHEDULE B
LOOP TRACK #2

S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.17



LEVEE ACCESS ROAD CROSSING

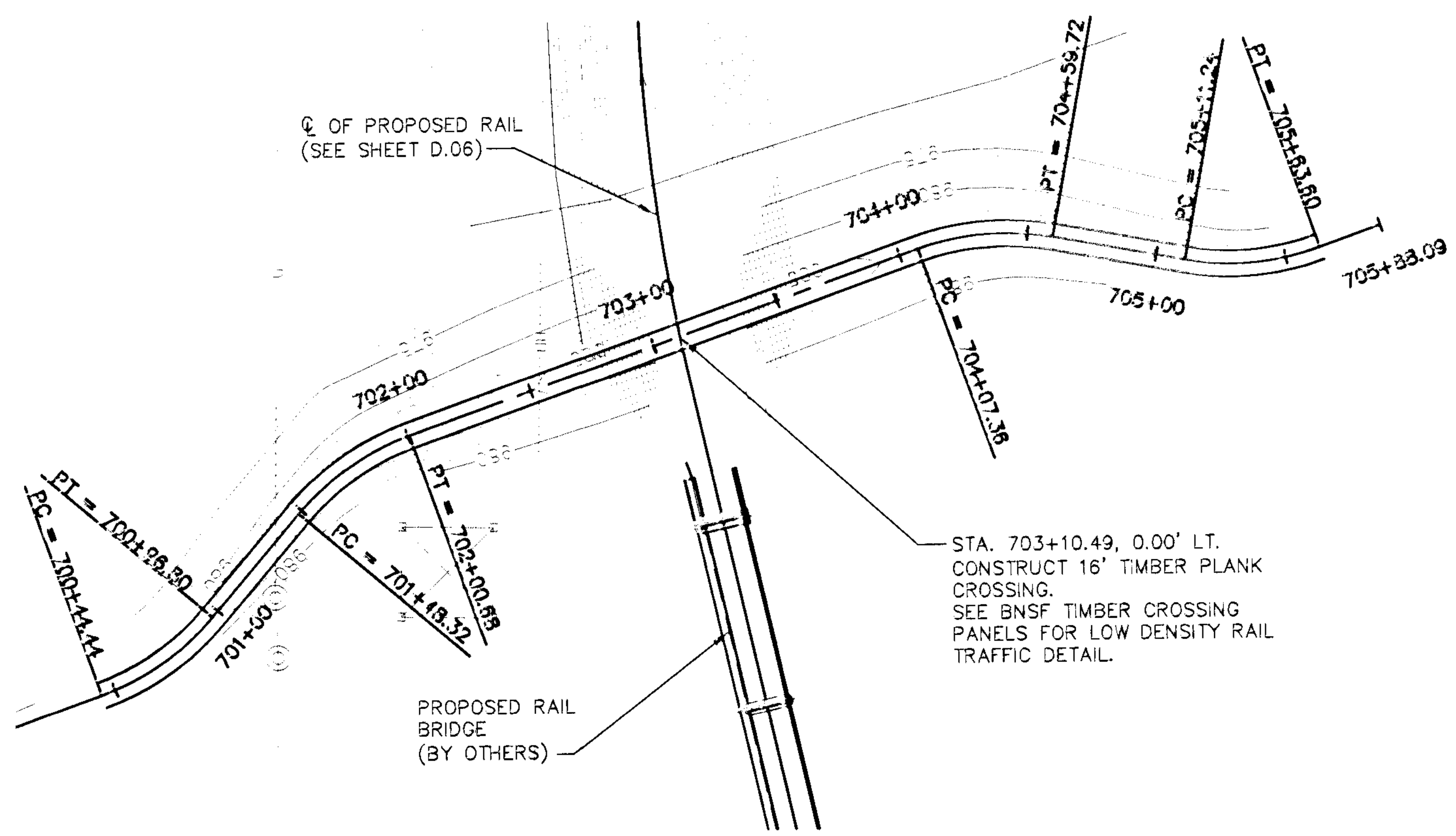


MID-AMERICAN ENERGY ACCESS ROAD CROSSING

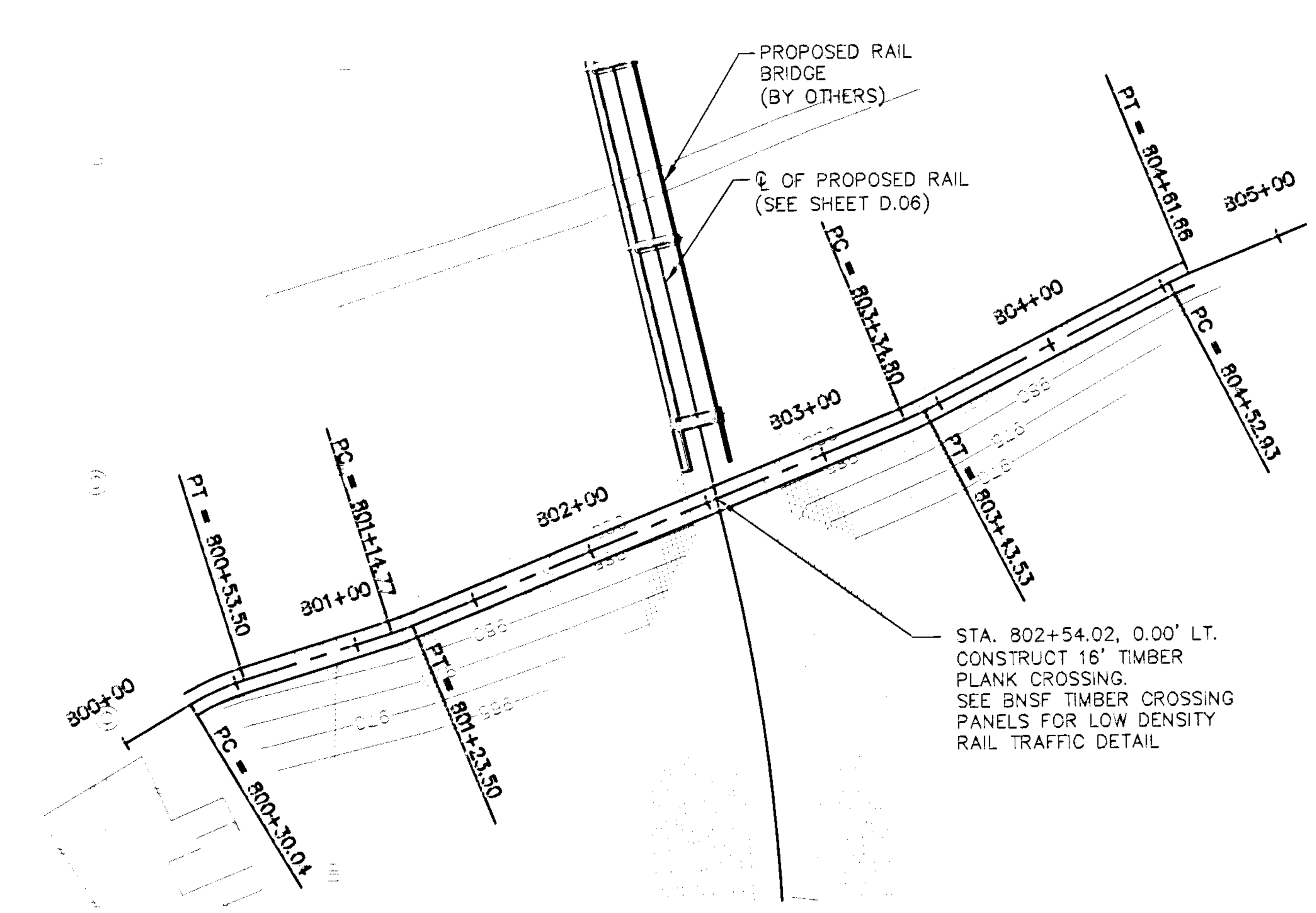
NOTES:

1. SEE SHEET C.02 FOR TYPICAL ROAD CROSS SECTION.
2. MID-AMERICAN ENERGY OPERATIONS IN THIS AREA SHALL NOT BE INTERRUPTED BY RAIL CONSTRUCTION AT ANY TIME.

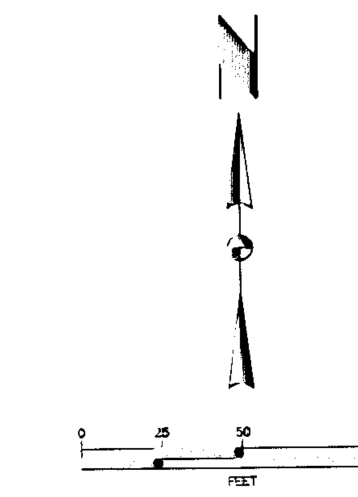
S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.18



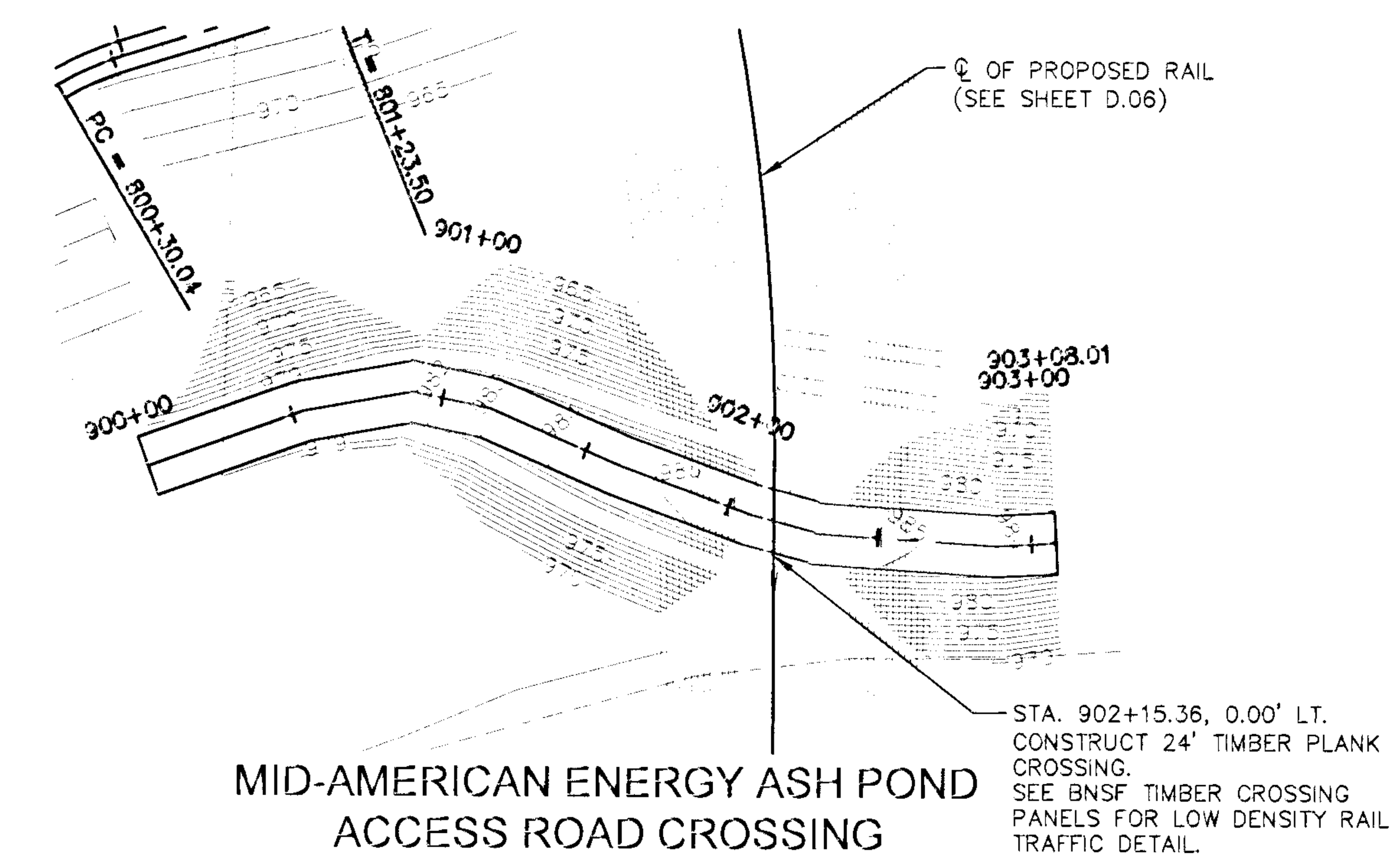
NORTH LEVEE ROAD CROSSING



SOUTH LEVEE ROAD CROSSING



S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.19



S.I.R.E. ETHANOL PLANT, RAIL SPUR AND STORAGE LOOP, HGM # 11315 SHEET D.20

February 11, 2011

HGM Associates, Inc
640 5th Avenue
Council Bluffs, Iowa 51502

Attention: Mr. Terry Smith, P.E.

Re: Addendum to Geotechnical Engineering Report
Preliminary Opinions of Global Stability
Ash Containment Pond Embankments
Walter Scott Energy Center
Council Bluffs, Iowa
Terracon Project No. 05105087

Dear Mr. Smith:

At the request of MidAmerican Energy Company (MEC), Terracon Consultants, Inc. (Terracon) completed a geotechnical report for this project to provide technical documentation regarding the global stability of the embankments (Terracon Project No. 05105087, report dated October 22, 2010). Our report was submitted to Dewberry & Davis, LLC (D&D) by MEC, and was utilized as supporting technical documentation for a draft report prepared by D&D to the United States Environmental Protection Agency (EPA), entitled “Coal Combustion Waste Impoundment, Round 7 – Dam Assessment Report, Walter Scott Junior Energy Center (Site #14), MidAmerican Energy Company, Council Bluffs, Iowa”. In this referenced draft report, D&D recommends that MEC conduct or provide documentation of additional analyses, including:

- Under-seepage analysis
- Liquefaction potential analysis
- Investigation of the low dike embankment crest elevation near the south end of the east dike.

This letter is presented to address the liquefaction and low dike area concerns. Additional analysis and separate report will be provided to address under-seepage.

1.0 Liquefaction Potential

Liquefaction potential for the sandy alluvial soils was evaluated using the methodology recommended in the paper “Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils, Youd and Idress, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 127, No. 4, April, 2001. The analysis was completed based on Boring 6 of our October 22, 2010 report, which exhibited the lowest SPT blow count data with the sandy alluvium of the borings completed for our study.

The United States Geologic Survey (USGS) 2008 NSHMP PSHA Interactive Deaggregation web site was utililized for determination of the peak horizontal acceleration (a_{max}) at the ground surface. The USGS provided an a_{max} of 0.071g based on a soft rock profile, with a mean event magnitude of 5.75 for a 0.1% probability in 50 years (4975 year return time). The histogram plot provided by the website is attached as Exhibit 1. The a_{max} used in our analysis was adjusted using a F_a of 1.6, as indicated in the 2006 IBC for a Site Class D, soil profile, resulting in an a_{max} of 0.112g.

The Cyclic Resistance Ration ($CRR_{7.5}$) was calculated for clean sand with a 7.5 earthquake magnitude, based on the blow counts adjusted for energy and normalized for overburden stress and other factors. The CRR is then determined by multiplying the $CRR_{7.5}$ by the Magnitude Scaling Factor (MSF) for the design earthquake magnitude. The Cyclic Stress Ration (CSR) was calculated based on the corrected SPT blow count and the ratio of total to effective vertical stress.

The factor of safety with regard to liquefaction potential is calculated as the ratio of CRR to the CSR, after adjustments for MSF and a confining stress factor, $k\sigma$. The results of our analysis are presented in the attached table, Exhibit 2. Based on our analysis, the factor of safety for liquefaction potential is above 1.6 for the sandy alluvial soils observed in our borings. The clay soils at the site are generally high plasticity clay soils and are not considered to be liquefiable. Therefore, the soils at this site do not appear to be susceptible to liquefaction under a peak horizontal ground motion of 0.112 or less.

2.0 Low Embankment Crest Elevation

A soil boring, B-2 was completed within the lower elevation embankment in the area of Station 22+00 to 25+00, HGM Associates Inc. (HGM) survey dated October, 2010 (HGM Project No. 112510). The embankment crest elevation was recorded to be about 973.7 to 974 feet in this area and the surrounding areas of embankment appear to be about 4 to 6 feet higher. Although we do not know the history or height of fill placement in this area of the embankment, it is likely that at least some of this depression is due to the underlying soft clay soils encountered in Boring 2. Exploration to the north and west of this location indicate less compressible soil profiles.

Based on the planned construction of these levees in the 1970's indicated in drawings by Black and Veatch, it is our opinion that most of the settlement due to the fill placement has taken place by this time. However, it is likely that the deep clay deposits will undergo some additional settlement due to both primary and secondary consolidation. Our analysis of the embankment stability in this area is documented in our report dated October 22, 2010, and indicates factors of safety in excess of 1.8 for both steady state and pseudo-static seismic stability at this location (Section E-E).

Based on our analysis, the very soft clay layer does not present a stability concern for the embankment for either steady state or design earthquake conditions at this site. We have been informed by MEC that the current embankment height will provide at least 2 feet of freeboard above the maximum anticipated water levels of the ash containment pond. Consideration should be given to monitoring the embankment crest height to assure that adequate freeboard is maintained. Alternatively, the embankment may be raised, if necessary to provide additional freeboard, however, stability of the revised section should be evaluated prior to significantly altering the embankment profile.

This letter report has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, express or implied, are intended or made. We appreciate the opportunity to be of service to you on this project. If you have any questions regarding this addendum report, please contact us.

Sincerely,

Terracon Consultants, Inc.

Edward D. Prost, Jr., P.E.
Principal

for Lok M. Sharma, P.E.
Sr. Principal

Report Distribution: Addressee (2, 1 via e-mail)

LICENSED PROFESSIONAL ENGINEER EDWARD D. PROST, JR. 12790 IOWA	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. Edward D. Prost Jr., P.E. — 2-11-11 (date) My license renewal date is December 31, 2012. Pages or sheets covered by this seal: Geotechnical Engineering Report

Exhibits

PSH Deaggregation on NEHRP BC rock
WSEC_Ash_Ponds 95.841° W, 41.196 N.
Peak Horiz. Ground Accel.>=0.07096 g
Ann. Exceedance Rate .197E-03. Mean Return Time 4975 years
Mean (R,M,ε_0) 86.6 km, 5.75, 0.13
Modal (R,M,ε_0) = 17.9 km, 4.80, -0.75 (from peak R,M bin)
Modal (R,M,ε*) = 19.0 km, 4.80, 0 to 1 sigma (from peak R,M,ε bin)
Binning: DeltaR 25. km, deltaM=0.2, Deltaε=1.0

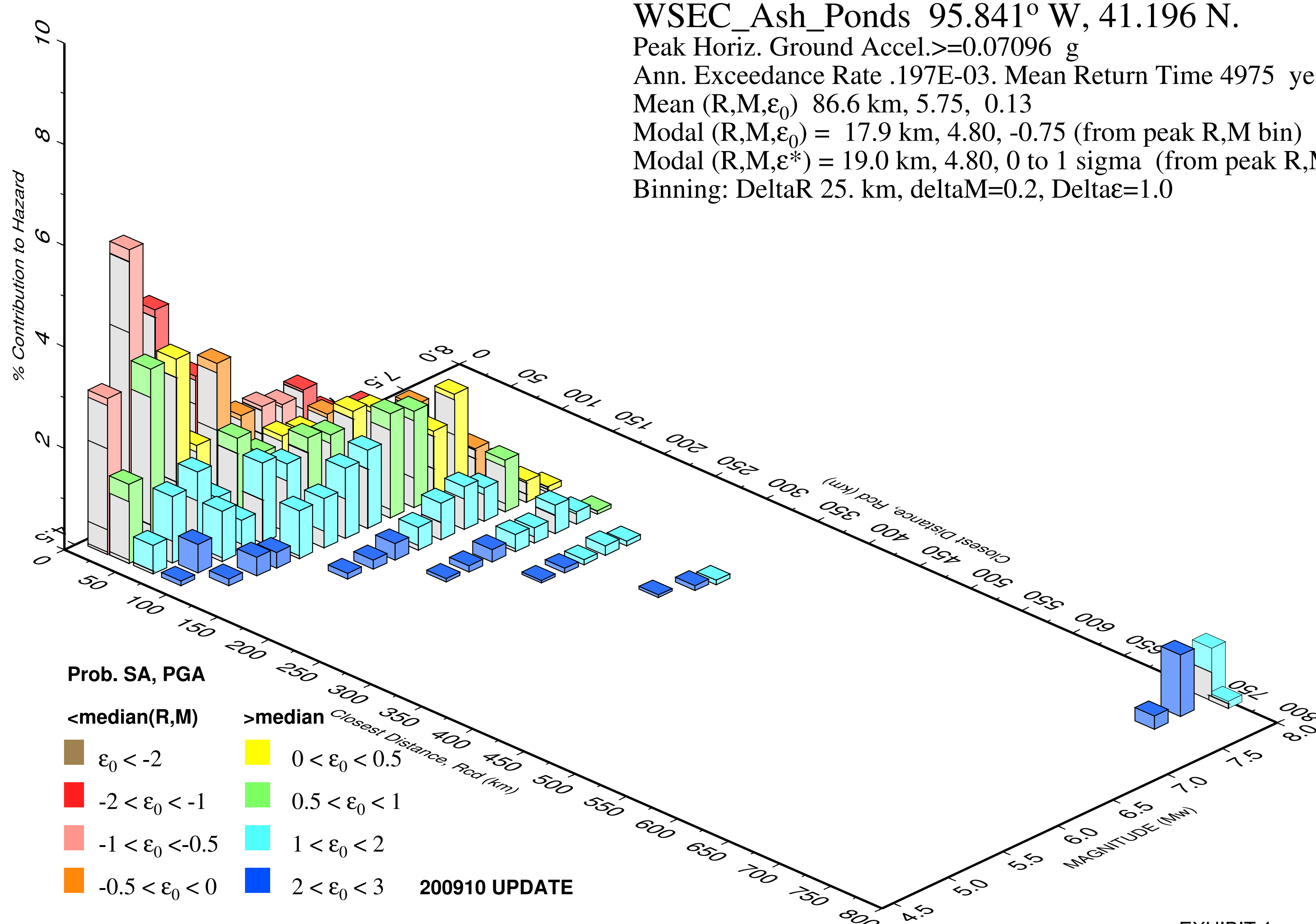


EXHIBIT 1

GMT 2011 Feb 10 19:11:22 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

05105087

MidAmerican Energy WSEC Ash Ponds

2/10/2011

Methodology:

SPT-Based Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshop on Evaluation of Liquefaction Resistance of Soils, Youd and Idress, JGGE, Vol. 127, No. 4, April, 2001

Boring No. B-6 WT 18 feet

a_{max}/g = 0.11216 Mw = 5.75 MSF = 1.97 = 10^2.24/Mw^2.56 C_E = 1.3

Depth, ft	N	γ_{total}	σ_{vo}	$\sigma_{vo'}$	z, meters	r_d	C_N	C_s	(N1)60	$CRR_{7.5}$	CSR	K_σ	FS
19	7	120	2280	2218	5.7912	0.959	0.95	1.10	9.5	0.1091	0.0719	0.95	2.84
24	27	120	2880	2506	7.3152	0.945	0.90	1.30	40.9	0.1540	0.0792	0.95	3.65
29	14	120	3480	2794	8.8392	0.925	0.85	1.18	18.2	0.1944	0.0840	0.93	4.25
34	11	120	4080	3082	10.3632	0.897	0.80	1.13	13.0	0.1402	0.0866	0.9	2.88
39	6	120	4680	3370	11.8872	0.860	0.76	1.10	6.5	0.0840	0.0870	0.87	1.66
44	16	120	5280	3658	13.4112	0.814	0.73	1.18	17.8	0.1896	0.0856	0.85	3.71

EXHIBIT 2

January 14, 2010

HGM Associates, Inc
640 5th Avenue
Council Bluffs, Iowa 51502

Attention: Mr. Terry Smith, P.E.

Re: Geotechnical Engineering Report – Addendum No. 1
South Ash Containment Pond Embankments
Seismic Analysis of Remedial Design
Riverside Generating Station
Bettendorf, Iowa
Terracon Project No. 07105081/02105081G

Dear Mr. Smith:

Terracon Consultants, Inc. (Terracon) previously submitted a geotechnical report documenting global stability analyses of selected Ash Containment Pond embankments at the Riverside Generating Station (RGS), including recommendations regarding remedial measures to increase the global stability of the embankments. MEC subsequently received the following review comments from Mr. Fredric Shmurak, PE, CFM of Dewberry via email:

> "The RGS report is based on the analysis and safety standards for levees. Levees are defined as embankments subject to water loading for only a few days or weeks a year (USACE). The embankments that impound coal combustion residuals should be treated as dams, not just levees, and should be analyzed and evaluated according to safety standards for dams, where the levee standard are not as stringent as those for dams (e.g., seismic loading conditions are not required for levees subject to less than 0.10g acceleration; whereas for dams this loading condition would be evaluated).
>
> Considering the static stability analyses results as borderline acceptable for a dam, and assuming that these embankments have a low hazard potential classification, we would recommend that pseudo-static analysis be performed for documentation purposes."

At the request of MEC, Terracon analyzed the riverside embankment slopes, including the remedial measures recommended in our geotechnical report, under pseudo-static seismic loading conditions. Analyses were performed for the full steady state (long term) seepage condition. The peak horizontal ground acceleration for this site was obtained from the USGS probabilistic seismic hazard maps. The peak horizontal ground acceleration given for this site was 0.051g for a mean return time of 2475 years (2% probability of exceedance in 50 years). Copies of the data obtained from the USGS (Exhibits H-1 and H-2) for this project are appended to this addendum. In accordance with IBC 2003 guidance, a horizontal acceleration of 0.034g and vertical acceleration of 0.023g were used in the analysis.

Results of the pseudo-static seismic global stability analyses for cross sections A through E are appended in Exhibits H-3 through H-7. Global stability factors of safety range from 1.28 to 1.37, well above the required minimum factor of safety range of 1.0 to 1.1.

This addendum and the recommendations contained herein are considered part of, and should be attached to, our geotechnical report for the project. All recommendations, opinions and limitations contained in the original geotechnical report that are not specifically addressed in this addendum remain valid.

Sincerely,
Terracon Consultants, Inc.

Kathleen E. Loft

for Steven M. Levorson, Ph.D., P.E.
Senior Consultant

Vaughn Rupnow, P.E.
Iowa No. 19259

LICENSED PROFESSIONAL ENGINEER VAUGHN RUPNOW 19259 IOWA	I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa. Vaughn Rupnow, P.E. — Date 1/14/2011 My license renewal date is December 31, 2012.

Attachments

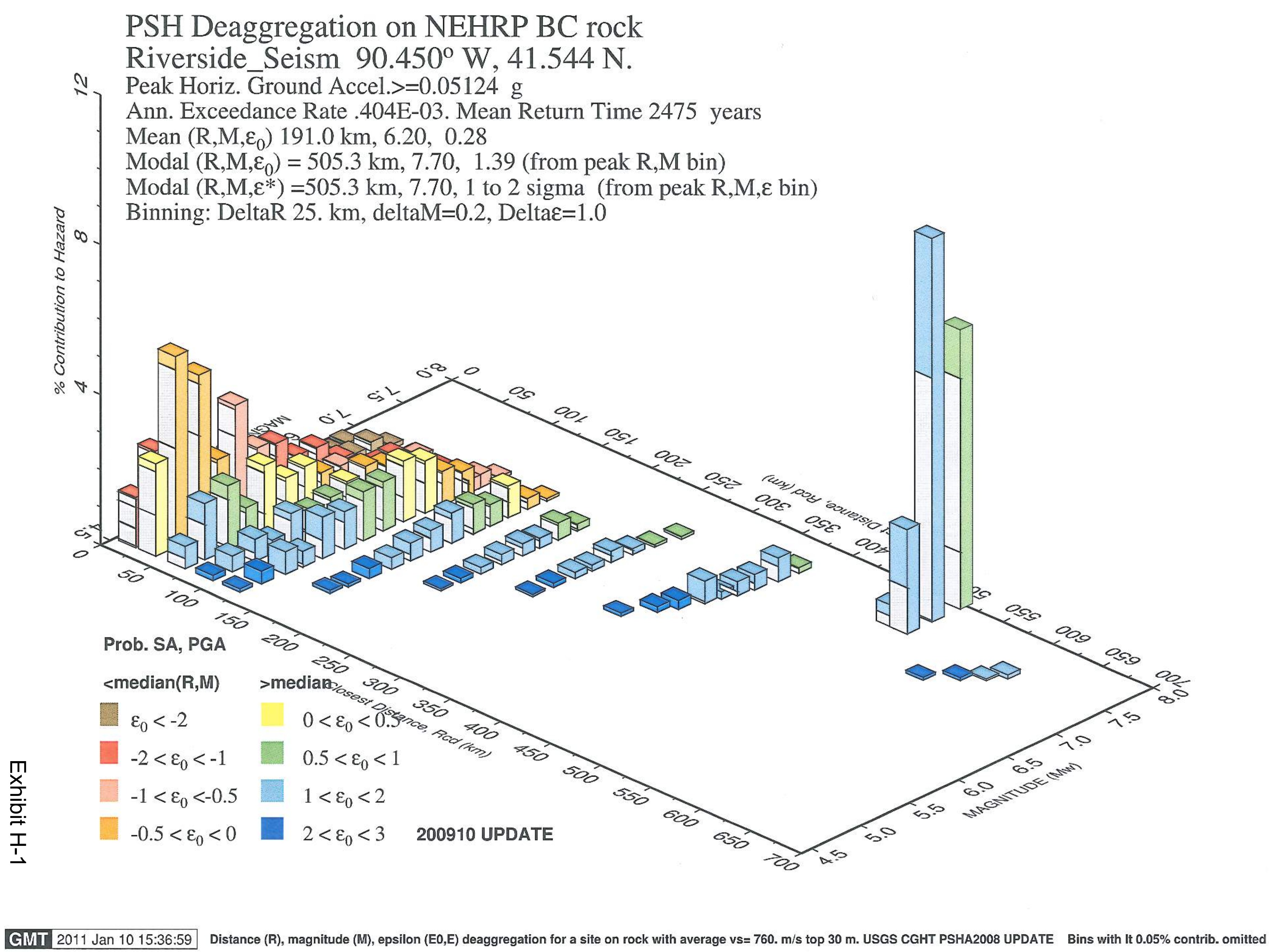

PSH Deaggregation on NEHRP BC rock
Riverside_Seism 90.450° W, 41.544 N.
Peak Horiz. Ground Accel.>=0.05124 g
Ann. Exceedance Rate .404E-03. Mean Return Time 2475 years
Mean (R,M,ε0) 191.0 km, 6.20, 0.28
Modal (R,M,ε0) = 505.3 km, 7.70, 1.39 (from peak R,M bin)
Modal (R,M,ε*) =505.3 km, 7.70, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 25. km, deltaM=0.2, Deltaε=1.0
% Contribution to Hazard
Closest Distance, Rcd (km)
MAGNITUDE (Mw)
Prob. SA, PGA
<median(R,M)
>median
ε0 < -2
-2 < ε0 < -1
-1 < ε0 <-0.5
-0.5 < ε0 < 0
0 < ε0 < 0.5
0.5 < ε0 < 1
1 < ε0 < 2
2 < ε0 < 3
200910 UPDATE
GMT 2011 Jan 10 15:36:59
Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on rock with average vs= 760. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

Exhibit H-1

*** Deaggregation of Seismic Hazard at One Period of Spectral Accel. ***
*** Data from U.S.G.S. National Seismic Hazards Mapping Project, 2008 version ***
PSHA Deaggregation. %contributions. site: Riverside_Seism long: 90.450 W., lat: 41.544 N.
Vs30(m/s)= 760.0 CEUS atten. model site cl BC(firm) or A(hard).
NSHMP 2007-08 See USGS OFR 2008-1128. dM=0.2 below
Return period: 475 yrs. Exceedance PGA =0.01890 g. Weight * Computed_Rate_Ex 0.211E-02
#Pr[at least one eq with median motion>=PGA in 50 yrs]=0.05528
#This deaggregation corresponds to Mean Hazard w/all GMPEs

DIST(KM)	MAG(MW)	ALL_EPS	EPSILON>2	1<EPS<2	0<EPS<1	-1<EPS<0	-2<EPS<-1	EPS<-2
13.4	4.60	0.309	0.007	0.043	0.109	0.109	0.038	0.002
35.1	4.60	1.145	0.041	0.248	0.607	0.247	0.002	0.000
63.8	4.60	0.801	0.067	0.401	0.333	0.000	0.000	0.000
89.8	4.61	0.412	0.068	0.334	0.011	0.000	0.000	0.000
121.6	4.61	0.592	0.217	0.375	0.000	0.000	0.000	0.000
168.7	4.61	0.178	0.168	0.010	0.000	0.000	0.000	0.000
13.4	4.79	0.516	0.012	0.071	0.179	0.179	0.068	0.006
35.5	4.80	2.098	0.068	0.408	1.024	0.576	0.022	0.000
64.1	4.80	1.667	0.110	0.660	0.891	0.005	0.000	0.000
89.9	4.80	0.950	0.112	0.653	0.185	0.000	0.000	0.000
122.3	4.80	1.524	0.357	1.155	0.011	0.000	0.000	0.000
169.4	4.81	0.537	0.392	0.144	0.000	0.000	0.000	0.000
218.6	4.81	0.118	0.118	0.000	0.000	0.000	0.000	0.000
13.5	5.03	0.337	0.008	0.046	0.116	0.116	0.046	0.005
35.9	5.03	1.519	0.044	0.263	0.661	0.507	0.044	0.000
64.5	5.03	1.426	0.071	0.426	0.866	0.063	0.000	0.000
90.1	5.03	0.926	0.072	0.430	0.424	0.000	0.000	0.000
123.0	5.03	1.694	0.231	1.216	0.247	0.000	0.000	0.000
170.3	5.04	0.732	0.299	0.433	0.000	0.000	0.000	0.000
219.8	5.04	0.207	0.197	0.010	0.000	0.000	0.000	0.000
270.6	5.05	0.061	0.061	0.000	0.000	0.000	0.000	0.000
13.5	5.21	0.121	0.003	0.017	0.041	0.041	0.017	0.002
36.1	5.21	0.583	0.016	0.094	0.237	0.211	0.026	0.000
64.8	5.21	0.612	0.026	0.153	0.369	0.065	0.000	0.000
90.2	5.21	0.435	0.026	0.154	0.255	0.000	0.000	0.000
123.6	5.21	0.875	0.083	0.493	0.299	0.000	0.000	0.000
170.9	5.21	0.439	0.107	0.332	0.000	0.000	0.000	0.000
220.4	5.21	0.145	0.107	0.037	0.000	0.000	0.000	0.000
272.0	5.21	0.053	0.053	0.000	0.000	0.000	0.000	0.000
13.5	5.39	0.176	0.004	0.024	0.060	0.060	0.024	0.004
36.3	5.39	0.889	0.023	0.137	0.343	0.330	0.056	0.000
65.1	5.39	1.022	0.037	0.221	0.555	0.208	0.000	0.000
90.3	5.40	0.785	0.037	0.223	0.509	0.015	0.000	0.000
124.1	5.40	1.727	0.120	0.715	0.892	0.000	0.000	0.000
171.5	5.40	1.004	0.155	0.748	0.101	0.000	0.000	0.000
221.1	5.40	0.385	0.169	0.216	0.000	0.000	0.000	0.000
272.9	5.41	0.171	0.162	0.009	0.000	0.000	0.000	0.000
336.2	5.41	0.126	0.126	0.000	0.000	0.000	0.000	0.000
13.5	5.61	0.083	0.002	0.011	0.028	0.028	0.011	0.002
36.5	5.61	0.438	0.011	0.064	0.161	0.161	0.039	0.001
65.3	5.61	0.554	0.017	0.104	0.261	0.170	0.000	0.000
90.4	5.61	0.462	0.018	0.105	0.264	0.075	0.000	0.000
124.7	5.62	1.118	0.056	0.337	0.701	0.024	0.000	0.000
172.2	5.62	0.765	0.073	0.434	0.258	0.000	0.000	0.000
221.8	5.62	0.351	0.080	0.268	0.003	0.000	0.000	0.000
273.7	5.62	0.189	0.117	0.071	0.000	0.000	0.000	0.000
345.2	5.59	0.129	0.129	0.000	0.000	0.000	0.000	0.000
353.6	5.69	0.083	0.081	0.002	0.000	0.000	0.000	0.000
13.5	5.80	0.071	0.002	0.010	0.024	0.024	0.010	0.002
36.7	5.80	0.387	0.009	0.055	0.139	0.139	0.043	0.002
65.5	5.80	0.518	0.015	0.090	0.225	0.184	0.003	0.000
90.4	5.80	0.451	0.015	0.091	0.228	0.118	0.000	0.000
125.0	5.74	0.459	0.021	0.125	0.291	0.022	0.000	0.000
125.2	5.85	0.697	0.028	0.165	0.413	0.092	0.000	0.000
172.8	5.81	0.890	0.063	0.377	0.450	0.000	0.000	0.000

Exhibit H-2

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT A 10ft Stabilized w 15 ft top(Steady State Seismic).gsz
Date: 1/11/2011 By: BWL

Horz Seismic Load: 0.0342
Vert Seismic Load: 0.0228

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Cement Stabilized Face Unit Weight: 115 pcf Cohesion: 2000 psf Phi: 0 °

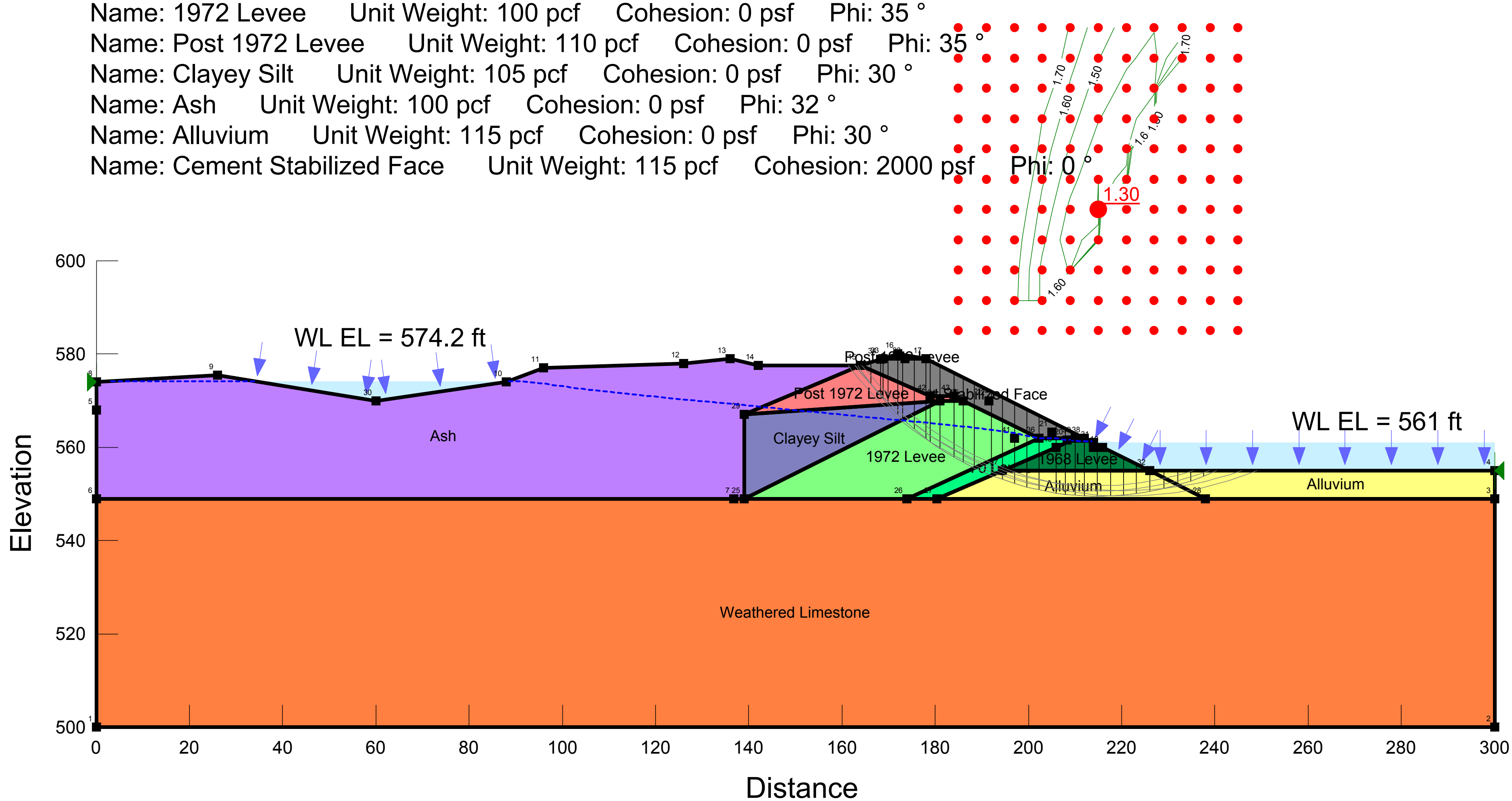


Exhibit H-3

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT B 10-ft Stabilized w 15-ft top (Steady State Seismic).gsz
Date: 1/11/2011 By: BWL

Horz Seismic Load: 0.0342
Vert Seismic Load: 0.0228

Name: 1968 Levee	Unit Weight: 120 pcf	Cohesion: 0 psf	Phi: 38 °
Name: 1970 Levee	Unit Weight: 100 pcf	Cohesion: 0 psf	Phi: 32 °
Name: Weathered Limestone	Unit Weight: 135 pcf	Cohesion: 0 psf	Phi: 40 °
Name: 1972 Levee	Unit Weight: 100 pcf	Cohesion: 0 psf	Phi: 35 °
Name: Post 1972 Levee	Unit Weight: 110 pcf	Cohesion: 0 psf	Phi: 35 °
Name: Clayey Silt	Unit Weight: 105 pcf	Cohesion: 0 psf	Phi: 30 °
Name: Ash	Unit Weight: 100 pcf	Cohesion: 0 psf	Phi: 32 °
Name: Alluvium	Unit Weight: 115 pcf	Cohesion: 0 psf	Phi: 30 °
Name: Cement Stabilized	Unit Weight: 115 pcf	Cohesion: 2000 psf	Phi: 0 °

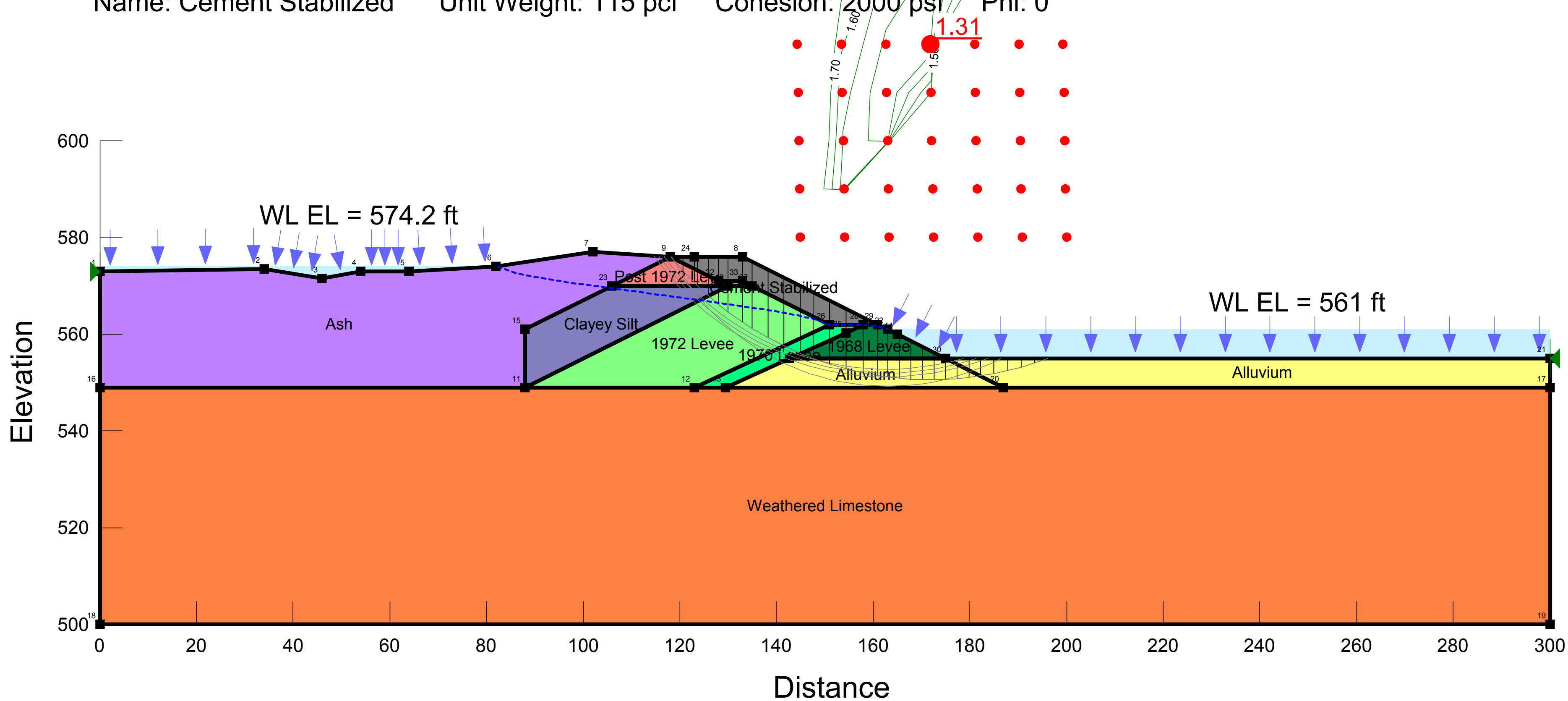


Exhibit H-4

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT C 10-ft Stabilized w 15-ft top (Steady State Seismic).gsz
Date: 1/11/2011 By: BWL

Horz Seismic Load: 0.0342
Vert Seismic Load: 0.0228

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Cement Stabilized Unit Weight: 115 pcf Cohesion: 2000 psf Phi: 0 °

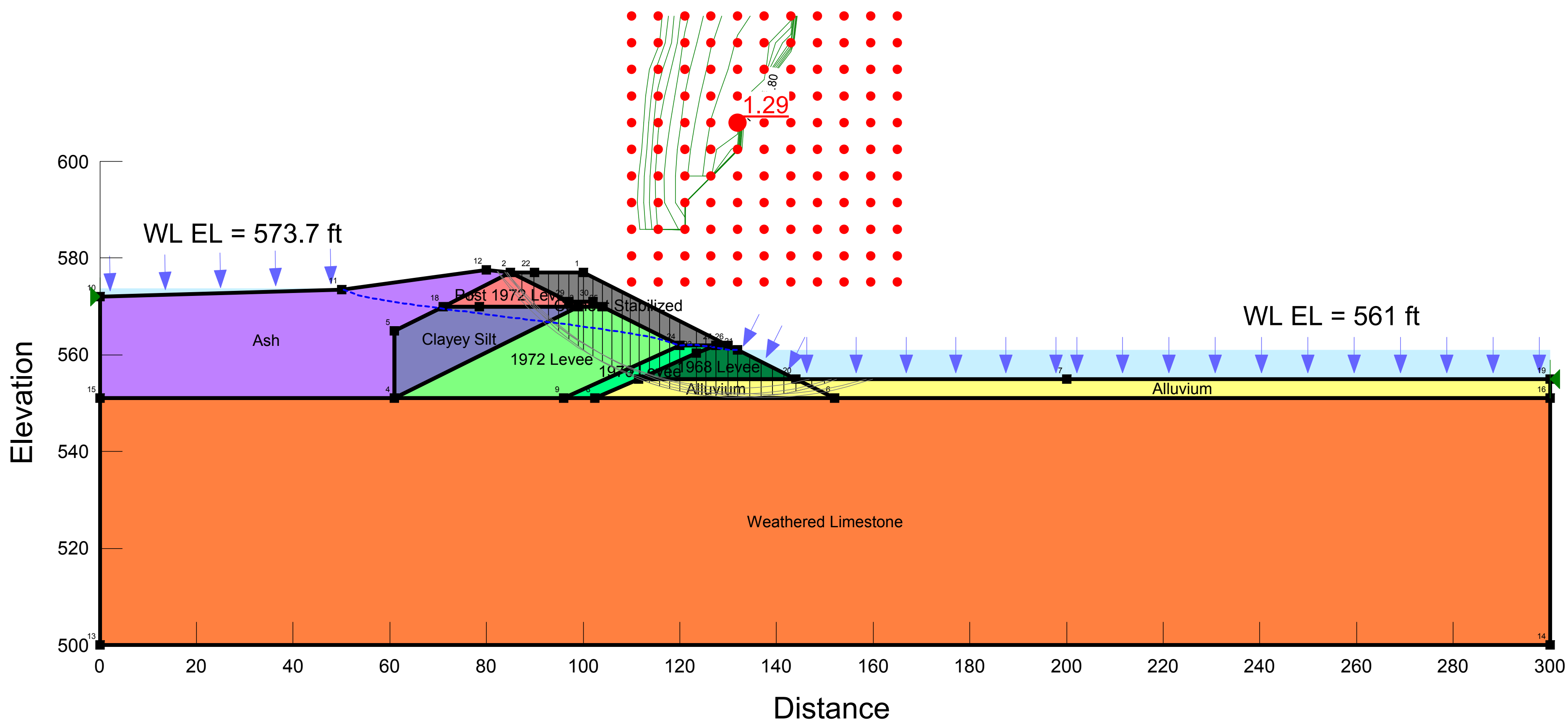


Exhibit H-5

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT D 10-ft Stabilized w 15ft top (Steady State Seismic).gsz
Date: 1/11/2011 By: BWL

Horz Seismic Load: 0.0342
Vert Seismic Load: 0.0228

Name: 1968 Levee Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 °
Name: 1970 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Weathered Limestone Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 °
Name: 1972 Levee Unit Weight: 100 pcf Cohesion: 0 psf Phi: 35 °
Name: Post 1972 Levee Unit Weight: 110 pcf Cohesion: 0 psf Phi: 35 °
Name: Clayey Silt Unit Weight: 105 pcf Cohesion: 0 psf Phi: 30 °
Name: Ash Unit Weight: 100 pcf Cohesion: 0 psf Phi: 32 °
Name: Alluvium Unit Weight: 115 pcf Cohesion: 0 psf Phi: 30 °
Name: Cement Stabilized Unit Weight: 115 pcf Cohesion: 2000 psf Phi: 0 °

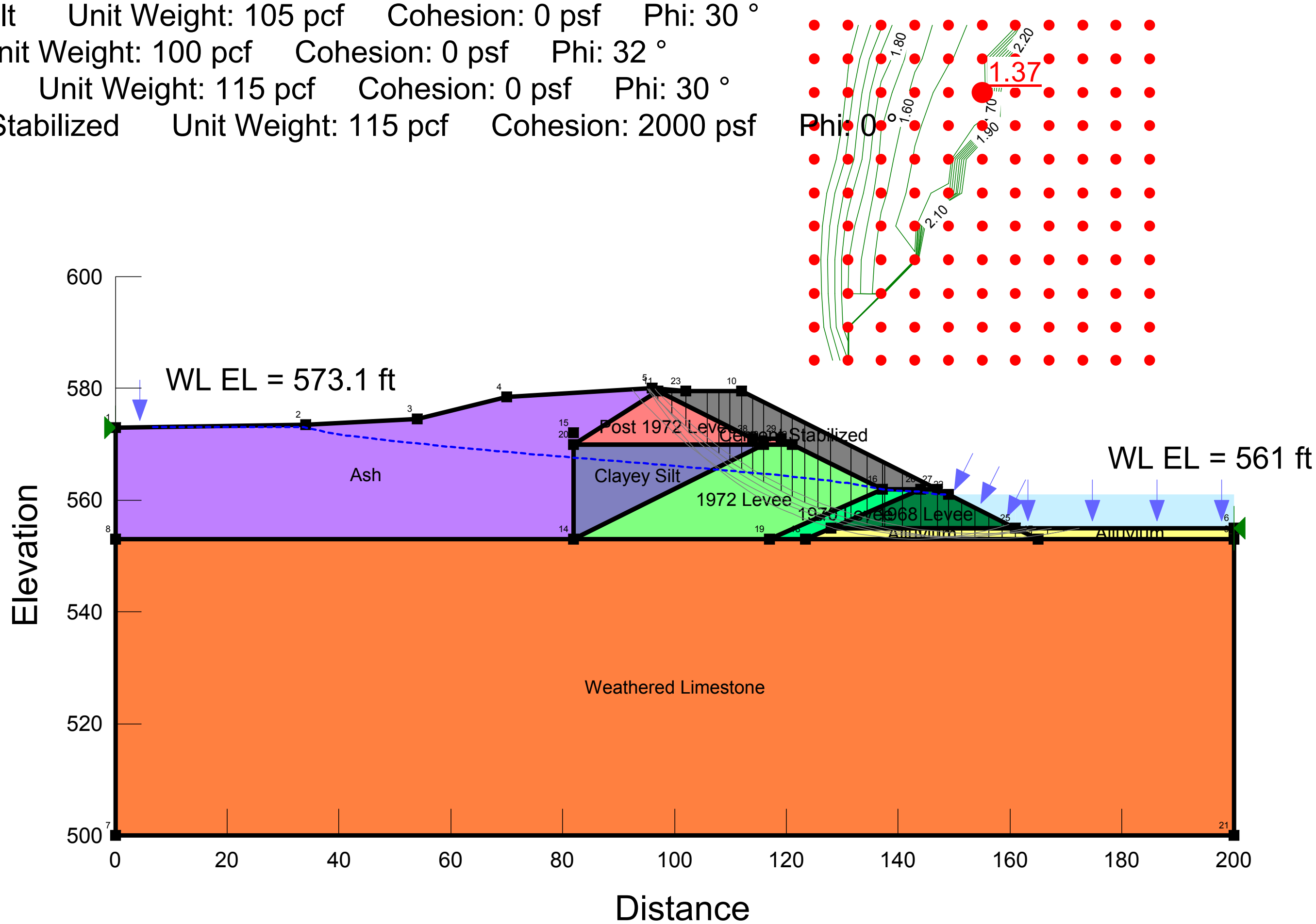


Exhibit H-6

Title: 10-ft Stabilized Face - Steady State Seepage
File Name: SECT E 10-ft Stabilized w top 15 ft (Steady State).gsz
Date: 1/11/2011 By: BWL

Horz Seismic Load: 0.0342
Vert Seismic Load: 0.0228

Name	Unit Weight	Cohesion	Phi
1968 Levee	120 pcf	0 psf	38 °
1970 Levee	100 pcf	0 psf	32 °
Weathered Limestone	135 pcf	0 psf	40 °
1972 Levee	100 pcf	0 psf	35 °
Post 1972 Levee	110 pcf	0 psf	35 °
Clayey Silt	105 pcf	0 psf	30 °
Ash	100 pcf	0 psf	32 °
Alluvium	115 pcf	0 psf	30 °
Cement Stabilized	115 pcf	2000 psf	0 °

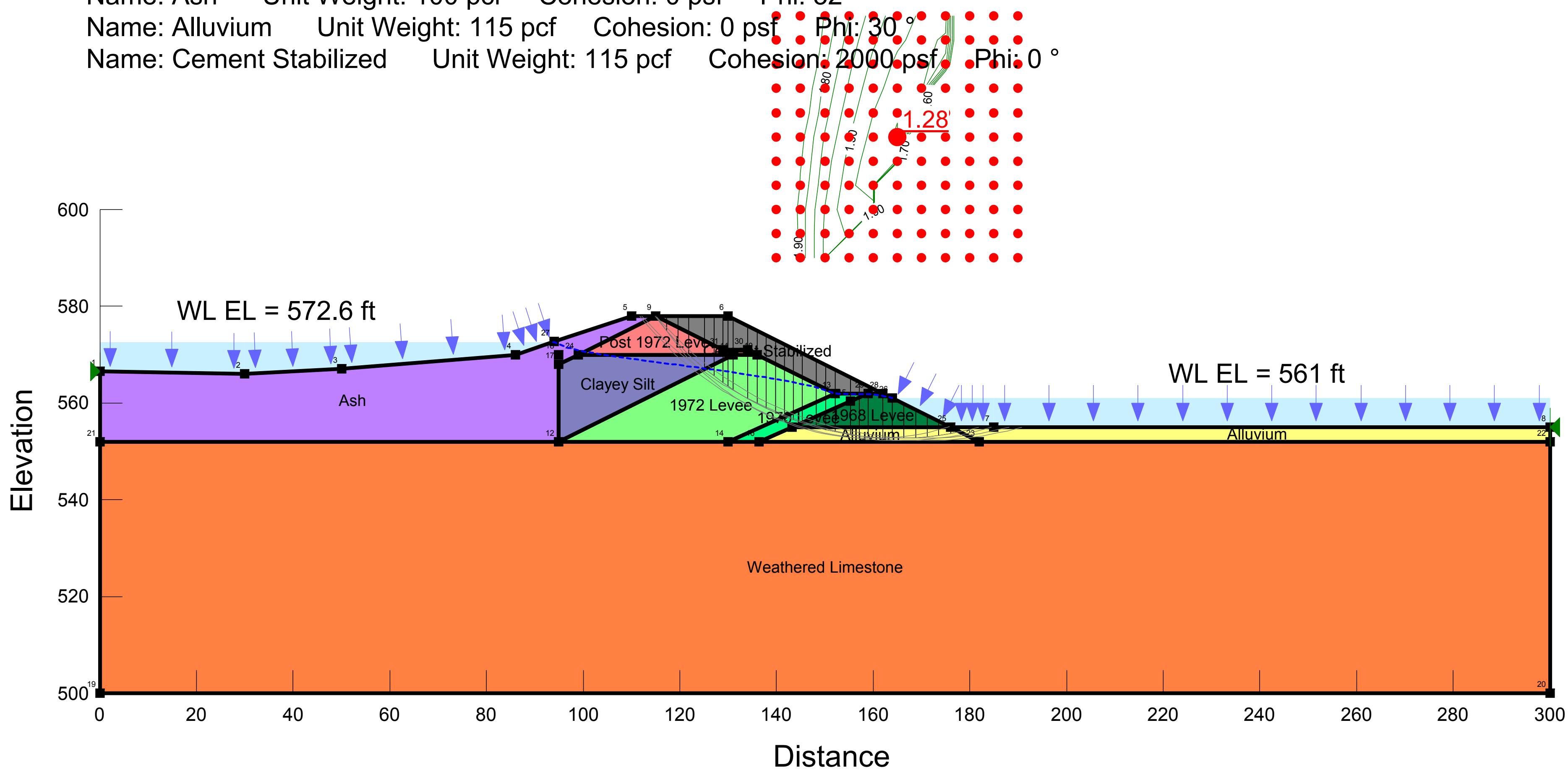


Exhibit H-7